CONTRACTOR RESPONSIBILITY FOR CONSTRUCTION INSPECTION AND QUALITY CONTROL

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Contractor Responsibility for Construction Inspection and Quality Control

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The Naval Facilities Engineering Command is using an inspection program in its construction contracts called Contractor Quality Control (CQC) which is defined as "a management system established and maintained by the contractor that assures compliance with the contract plans and specifications"; it includes necessary tests and inspections for the control of quality. Although the major responsibility for inspection lies with the contractor the Navy contract administrators perform inspections and tests to ensure that the contractor's program is functioning effectively and they have final acceptance authority. To evaluate the effectiveness of the Navy's CQC program and to determine the feasibility of its use on nongovernment projects, a questionnaire was used to determine the cross-section of attitudes and opinions that exist concerning the shifting of the responsibility for inspection and quality control to the contractor. A response of 160 (63%) was received. The architect/engineers and the majority of the contractors believed that the designer's representative should have the responsibility for the inspection and quality control under the normal one year warranty. Twenty seven percent of the designers were willing to allow the contractor to have full responsibility for the inspection with an extended warranty of three years. It is believed that two reasons affected their

decision to use CQC in some of their contracts. The first involves fee problems and additional cost to the owner, and the second is based upon the belief that the contractor should be responsible for quality control.

The architect/engineers who did not want the contractor to have the full responsibility for the inspection even with an extended warranty indicated that they felt that there would be a conflict of interest in the utilization of CQC. They believed that the designer is the best team member to inspect the construction work. Forty four percent of the contractor respondents indicated that they would like to have the full responsibility for the inspection with a one and a half year extended warranty. They believed that they could inspect the work better than the designer without a conflict of interest. The contractors who did not want the responsibility for the inspection (56%) had a high regard for designer inspection.

The many diverse replies from the Navy related respondents (CQC contractors, CQC representatives, and Navy personnel) implied that there might be some nonuniformity in the administration of CQC contracts. These respondents believed that CQC has "often" given the contractor more control of his operations and helped to identify construction problems and solutions earlier. It has been indicated that more specificity is wasted in the required numbers and qualifications of CQC personnel.

The Navy personnel who want to return to government inspection (52%) indicated that the Navy received better work before the program was used. The Navy respondents (48%) who want to retain

the CQC provisions in the contract responded that the majority of the contractors provide a level of quality that is equal to that specified, and that CQC contractors have "often" provided satisfactory inspection. The CQC contractors who wanted to return the inspection responsibility to the Navy (37%) indicated that the cost of a satisfactory CQC program is too expensive to provide. The CQC contractors who want to retain the CQC provisions in their contracts have found that the benefits of CQC to the contractor surpass the costs of the program to the owner.

Out of 160 respondents, about one half (48%) wanted to keep the CQC provisions in their contracts. The use of CQC on non-government construction can be justified on projects greater than $1 million in which cooperation among the members of the building team can be expected.

This abstract is approved as to form and content.

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CHAPTER I

INTRODUCTION

The construction of all types of projects throughout the ages has resulted in great engineering feats that stand as monuments to civilized man. The pyraminds of Egypt, the Roman Forum, St. Peter's Basilica, and the governmental buildings in Washington, D. C. are the results of a process that started with the need of an owner and produced the design and construction of a new structure. An integral consideration was the control of men, machines, materials, and money. As early as 1750 B.C., King Hammurabi recognized the need to effectively protect the people from the unsatisfactory use of this process and, therefore, created a code which held the builder responsible for his finished product.[1] "The five basic rules covering failures are:

If a builder build a house for a man and do not make its construction firm and the house which he has built collapse and cause the death of the owner of the house - that builder shall be put to death.

If it cause the death of the son of the owner of the house - they shall put to death a son of the builder.

If it cause the death of a slave of the owner of the house - he shall give to the owner of the house a slave of equal value.

If it destroy property, he shall restore whatever it destroyed, and because he did not make the house which he built firm and

and it collapsed, he shall rebuild the house which collapsed at his own expense.

If a builder build a house for a man and do not make its construction meet the requirements and a wall fall in, that builder shall strengthen the wall at his own expense."[2] During the reign of Emporer Augustus of Rome, Vitruvius discussed the quality of materials and workmanship in his famous book De Architectura.[3] Feld wrote that during the Greco-Roman and Medieval periods time was no object and the quality of the work was so good that many of the structures have lasted for centuries. According to English common law which was found in fifteenth century court records, "if a carpenter undertake to build a house and does it ill, an action will lie against him". Under the Napoleonic code the responsibility of the designer and the professional in charge of the work, as the agent of the owner, was "to safeguard the investment and guarantee proper and adequate performance".[2]

The purpose of these historic codes was to protect the health, safety, and welfare of the individual. Architect/engineers (designers) and constructors must abide by our codes today by taking an active role in the control of their share of the quality. Typically the functions of inspection and quality control have been used to attain this goal during the construction phase of the project.

The representative definition of inspection in the literature was found to be those steps taken to examine all aspects of the job such as workmanship, materials, and methods to ensure compliance

with the contract documents; interpretation of the plans and specifications and final acceptance of the work were also included.[4,5,6,7] Quality control was explained as the active participation of individuals to ensure that the work meets the specified levels of quality in all of its aspects.[5,8]

The effectiveness of these functions has been reduced by design errors, unqualified inspectors, abuses, and lack of realization of the importance of inspection and quality control by different members of the building team. These problems have caused many people in the industry to re-evaluate their positions. Increased liability of designers to third parties and changes in the American Institute of Architects contract documents have created additional concern over the roles that individuals have taken during the construction phase.

Better methods of contract administration are being sought to alleviate some of these difficulties. In 1961, the Armed Services Procurement Regulations Committee adopted a new clause that stated that "the contractor shall (i) maintain an adequate inspection system and perform such inspections as will assure that the work performed under the contract conforms to contract requirements, and shall (ii) maintain and make available to the government adequate records of such inspections".[9] In march 1970, the Navy culminated a re-evaluation of its position in the construction industry and implemented an ambitious program called Contractor Quality Control (CQC). It was defined as "a management system established and maintained by the contractor that assures compliance with the contract plans and specifications".[10] The contractors who have

participated in this program have taken a more active role in the control of quality on their projects. Some of the benefits expected of this program, as outlined in the CQC Manual, are better use of personnel, more control by the contractor of his own operations and fewer claims. Economic savings due to the reduced amount of delays and to the increased probability of finding and correcting mistakes more quickly were also cited.[10] The Navy personnel have the responsibility to protect the interests of the U. S. Government by checking the quality of the project to ensure that the contractor's program is operating properly. In effect, there is less of a duplication of effort and more of a teamwork approach in order to get the best job for the least amount of money.

It is the purpose of this research to evaluate the CQC program that is employed by the Naval Facilities Engineering Command in order to determine its effectiveness as a method of contract administration, and to determine the feasibility of its use in the nongovernment part of the construction industry.

A questionnaire was used to provide the major research data in order to determine the cross-section of attitudes and opinions that exit concerning the responsibility for inspections and quality control. This information was combined with a literature review which established the necessary historical background for the conclusions of this thesis.

CHAPTER II

LITERATURE REVIEW

A. The Construction Process

A construction project is initiated by the desire of an owner for a residence, a highway, a church, or some other structure, according to Reiner. An architect/engineer is normally selected by the private or agency owner, and during the initial consultations the requirements are established and the budget is set. The result of these conferences and the schematic and design development stages culminates in the preparation of the contract documents. By competitive bid or negotiated contract, a contractor is selected to construct the project in accordance with the plans and specifications.[11]

The relationships described in the previous paragraph summarized the building process. The responsibility of each team member has a significant affect on the quality of the project.

The Owner

A recent article in the Journal of the American Concrete Institute (April, 1974) defined the owner as "the individual, company, or agency who has need for a structure, but does not have the ability to construct it himself and, therefore, must hire someone else. In short he is a buyer".[8] The competence of the design team that he has selected significantly influences construction, maintenance, insurance and other annual costs of the

project.[12] The AIA Handbook of Professional Practice (AIAHPP) (note: see the list of acronyms) expressed the importance of the establishment of the building requirements at the start of the consultations and of the creation of good communications with the designer, that must continue through the project until it is finally accepted.[13] Weinberg wrote that the owner must determine the level of quality that he desires, needs, or can afford. In addition to this, his resources of money and time must be made available to the design professional.[5]

The AIAHPP and the Manual of Practice of Consulting Engineering (MPCE) have delineated further the duties and responsibilities of the owner. He must pay for the services rendered to him during all phases of the construction process. Through his consultations the information he provides must be complete and adequate for the designer to do the best job for him. He must clearly define in writing the amount of money available for the project and how it is to be spent. His prompt and thorough consideration of all correspondence relating to the work and his comprehensive understanding of the contract documents, the design, and all of the other matters pertaining to the project facilitates the timely completion of the work. The active participation and cooperation of the owner is an important factor in the actual quality that is achieved. The designer can then incorporate the owner's requirements into the contract documents which makes each team member's job much easier.[13,14]

The owner and his designer must ensure that the specifications are reasonable and practical.[8] They should demand only what the contract documents indicate and must see that the requirements placed on each member of the building team are ethical. The owner can easily avoid these problems by clarifying his questions with the designer.[14]

There are various methods of contract administration. For example, the owner can retain the services of the designer, he can use his own in-house staff, or he can hire a consultant. The general indication was that no matter who performs that function, the owner has the ultimate responsibility to see his project through to its completion. In an article in Consulting Engineer, Goldbloom stated that there "are many owners who still believe that when the contract documents are completed and the job finally awarded, the major problems are over. This is wishful thinking, for the project is still only on paper and the work with its related problems is yet to come. Neither the owner nor the designer should assume that the desired quality of work will automatically come about because of good contract documents".[15]

Some owners feel that inspection is an added, unnecessary cost.[16] Birkeland further explained this problem by stating that their attitude of cutting costs often results in substandard or unsatisfactory construction. "The owner tries to lower the architect's fee, the architect tries to lower the structural engineer's fee, the contractor gets the job on the basis of low cost, then the laboratory quoting the lowest fee does materials testing. Then when we all get into trouble, we go to the best attorney we can

find, and never ask him about his fee."[17]

History has proven that quality control and inspection cost nothing in the long range due to reduced maintenance and lower cost of construction, according to Praeger. The owner pays for quality control whether he knows it or not. Manufacturer's guarantees, warranties, bonds, and insurance reflect the absence of quality control and owners pay for them.[18] Inspection of the work by both the owner's representatives and the contractor ensures that the plans and specifications are adhered to in such a way as to prevent unnecessary waste and costs.[19]

In an article in the Journal of the American Concrete Institute, Andrews and Gray discussed the importance of the owner using his money wisely and demanding the quality that his construction dollar is buying.[4] To achieve this goal the owner must recognize the importance of inspection and quality control, be willing to fund these functions, and ensure that the responsibilities and authority in the contract documents are clearly delineated.

The Design Professional

The architect/engineer is the next link in the chain of events leading up to a completed project. Sackett stated in an article in Progressive Architecture that the design professional not only has to design the structure according to the owner's wishes, but he has the responsibility to communicate that design to the builder. This must be done in a reasonable period of time with minimal problems in a situation where he has no legal control over the opera-

tions of the contractor.[20]

As an advisor to the owner, as outlined in the AIAHPP, the designer normally provides basic services which include development of the design and the contract documents and administration of the construction phase.[13] Wheeler stated that the architect's design must be complete and related to the capabilities of the construction industry. From this design "it is the responsibility of the design professionals to produce clear, understandable, and adequate [contract] documents".[8] Kingston stated that the quality of the job and the contingent costs are directly proportional to the excellence of the plans and specifications. Both the contractor and the inspector, especially if he is not the designer, must be able to extract the essential information to determine the necessary project requirements and to answer questions on required tests, quality of work and specified materials. According to Kingston, any ambiguous and contradictory terms in these documents leads to confusion and delay.[21] The consensus of the writers was that the best inspection and quality control can be rendered useless if the plans and specifications are unsatisfactory.

The AIAHPP and the MPCE indicated that the design professional's responsibilities during the construction phase include interpretation of the contract documents, approval of the work, and enforcement of the faithful performance of the parties to the contract.[13,14] Wheeler stated that the architect must visit the site to familiarize himself with the work progress and quality and to determine if this work is in accordance with the plans and specifications. He emphasized the idea that the designer is not

responsible for the means, methods, or sequences of the work.[8]

Clothier said that "quality control in construction is of paramount importance and the reputable contractor will be equally as anxious to insure it as will the reputable architect or engineer who designed it".[22] In 1939, George Lucas, in reference to concrete construction, stated that there was a need for coordination and cooperation between designers, specification writers, and field engineers.[23] It is the opinion of the author that the contractor should be added to that list because quality in construction is a team effort. The cooperation of all of the individuals in the construction process is vital to the success of inspection and quality control.

The Contractor

Dunham and Young defined the contractor as the "party (either individual or organization) who undertakes for a stated price to supply goods or to perform a construction job or other project for the owner. In the practice of civil architecture and construction, the contractor not only controls the work of construction but also acts as intermediary between the engineer or architect, who designs the work, and the artisans who execute it".[24] The owner and the contractor are normally parties to the contract, and the architect is not a signatory.

Merrill summarized the contractor's responsibility by stating that he selects his workmen, supervisors, subcontractors, equipment, materials, and construction methods. He agrees to provide the specified level of quality which he warrants for one year after

the project is completed. He must also comply with applicable codes and safety regulations relating to the work.[25] The owner should demand that the level of quality that is specified be provided.[26] The writers of the AIAHPP and the MPCE indicated that for these reasons the plans and specifications must clearly communicate the level of quality which will be considered acceptable.[13,14]

Antill reported that the motivating factors of a contractor are profit, prestige, client relationship, expansion, and full utilization of his plant and men.[26] It is not unprofessional to be motivated to make a profit.[5] Organization, control, good quality materials and workmanship, and profit are all interrelated.[27] Andrews said that few contractors place quality first; economics are primary with quality being secondary to prevent unsatisfactory work.[4]

Good job conditions, organization, people, personnel relations, and supervision produce a quality product at a profit under optimum conditions; in short, quality control directly benefits the contractor.[27] In contrast, poor management of these factors reduces both quality and profit.[28,4]

Keim said that contractors are resourceful and in most cases will do a good job for themselves and the owner.[29] Andrews and Rohde wrote that problems arise when the upper levels of management want to provide good work but fail to pass this desire down to the lower levels of the organization.[4,8] The good contractor knows that cutting corners will damage his reputation.[8] Wright and Rohde indicated that it is the contractor's superintendent in his efforts to keep the job out of the red who orders poor quality and/or

overlooks unsatisfactory conditions.[8,30] Rohde continued this discussion by stating that the individuals in the quality control chain who cause failures do it through a lack of knowledge, carelessness, or laziness which jeopardizes profits. As a result, the contractor must concern himself with quality control at all levels in his organization and ensure that all of his employees follow the company's objectives.[4,8]

A review of the literature indicated that a lack of attention to quality by some contractors has created feelings of distrust and disdain among the members of the building team. Tedesko and Sackett wrote that contractors as a whole have been wrongly indicted because many are striving to improve the quality of their management, workers, equipment, methods and construction by hiring better, more educated men.[20,31] Sackett stated that contractors and designers need to become more understanding and aware of each others problems.[20]

Inspection and Quality Control

Several definitions of inspection are as follows:

1. "Inspect - to look carefully at or over; view closely and critically: to inspect every part."[7]

2. The Armed Services Procurement Regulations defined inspection as "the examination (including testing) of supplies and services (including where appropriate raw materials, components and intermediate assemblies) to determine whether those materials and services conform to contract documents".[6]

3. Andrews wrote that inspection is "a control exercised by the owner or his representatives over materials, methods and workmanship used by the contractor in performance of his work".[4]

4. Weinberg stated that the inspection performed by the design professional or his agent is called acceptance inspection and it "represents a spot check of critical items from the viewpoint of the structural safety and integrity and of serviceability and maintenance to check compliance with design". It includes tests, inspections, and any other procedures that the owner feels is necessary.[5] Fling pointed out that construction inspection normally involves the three separate phases of interpretation of the plans and specifications, acceptance of the finished product, and the control of its quality.[5]

For the purposes of this paper inspection will be defined as those steps taken to interpret the plans and specifications and to examine all aspects of the work to ensure compliance with the contract documents. Included in this definition is the acceptance of the work. Inspection may be provided by the owner, the designer, a consultant, and/or the contractor.

Quality control is an important aspect of the inspection function and has several definitions:

1. Weinberg defined it as a "positive continuous program by the contractor to assure that the material and workmanship which he and his suppliers and subcontractors furnish to the project conform to contract requirements".[5]

2. Rohde stated that "construction quality controls are those steps taken to insure an end construction product of the agreed upon quality".[8]

Quality control, then, is the active participation of individuals to ensure that all aspects of the work meet the specified levels of quality. This may include testing of concrete cylinders, correct alignment of formwork and masonry walls and other control measures that are needed to maintain the required levels of quality. Quality control and inspection, according to Fling, are a team responsibility that involves the owner, the designer, the contractor, and the material supplier.[5] The necessary levels of inspection and quality control depend upon the project, the owner, the performance characteristics, the economics, the stage of the work and the safety considerations.[5] The ACI Committee 311 indicated that the skill and attitude of the contractor is an important factor.[32]

Nugent observed that "it is stating the obvious to point out that the best planned and designed work is rendered mediocre where comparable quality is not maintained in the inspection of construction for the structure. Unfortunately the obvious is too often overlooked or ignored".[33] Gnaedinger stated that "since so many on-the-spot decisions are necessary during construction, in many respects quality control during construction is more important than design and preparation of specifications, since design, plans and specifications are subjected to relatively leisurely review before construction".[34]

New designs and rapidly changing technology have increased the importance of inspection and quality control.[35] Feld wrote that "inspection, or the lack of it, has never caused a failure. It can only serve, by warning or even halting the work, to prevent the failure caused by some error or omissions for which others are responsibile. Competent control, on every level of responsibility, is the best insurance against mishaps".[36] Rohde placed these comments into perspective when he stated that owners, salesmen, designers, contractors, manufacturers, suppliers, testing laboratories, and consultants are all involved in the construction process, and they are all potential sources of human error.[8]

Fling summarized the importance of inspection and quality control when he said that it pays in reduced legal cases, failures and corrections; in better quality construction; and in better designed projects.[5] Several authors stated that it reduces construction and maintenance costs. Gardner illustrated the owner's and designer's viewpoint when he defined adequate inspection as that level of inspection that gets the job completed without serious problems. This protects the owner and designer from all construction defects, deficiencies, and future claims.[37] Pierson outlined the reasons that contractors want good inspection on their jobs. Included in his list were protection of the construction industry "from the criticism and loss of public confidence that would result from inferior work. Good inspection protects the contractor's reputation from the damage that would result from the unintentional failure of trusted employees to perform properly.

Good inspection protects him from being placed at the competitive disadvantage that would result if other contractors were allowed to do substandard work. Good inspection protects a contractor who follows others in stage construction or as a subcontractor".[35]

The Inspector

During the construction phase an inspector is given the responsibility to inspect the work. On smaller projects he may be a part-time man, and on larger projects there may be a fulltime staff on the job site. The inspector's ultimate responsibility is to the owner as his onsite representative to ensure that the work meets the quality specified in the contract documents. He may be on the payroll of any of the team members.

The functions of an inspector were the subject of many articles. Primary among them was the inspector's duty as an expeditor through the timely discovery of errors and their solutions. As an onsite representative of the owner he protects and integrates the interests of all of the members of the building team.[8,16,19,32,38,39,40,41] His capabilities may be augmented by the employment of a commercial laboratory for the testing of materials, processes, and strengths.[42]

Gardner wrote that some of the prerequisites of a good inspector are experience, judgment, knowledge of all phases of the construction industry, the ability to read plans and interpret specifications, the faculties to get along with people, the use of good, sound common sense, and the desire to maintain his level of knowledge through continuing education.[41] The writers of the

Bureau of Reclamation's Concrete Manual listed fairness, courtesy, cooperativeness; complied with practicality, firmness, and a businesslike demeanor that engenders respect and cooperation as important qualities of an inspector. They also pointed out that he must be conscious of the importance and scope of the work.[39]

Reinder stated that "it would seem that with all these inspection duties so clearly defined nothing much could go wrong during construction, but this is not so. The final quality of a construction project depends on the eternal vigilence of the inspector and a close knowledge of what to look for and how to look for it".[11] Friedman wrote that it is important for the inspector to size up the contractor at the start of the job to determine what level of inspection will be needed.[43] He must allow the contractor to perform his work in the most advantageous and profitable manner as long as the contractor is fulfilling the requirements of the specifications.[39]

Andrews said that the contractor's superintendent is normally selected with the utmost care and paid in proportion to the importance of his job. Due to an insufficient budget or a lack of concern the designer often does not select a qualified inspector. This situation usually results in resentment of the superintendent by the underpaid inspector, who "due to his lack of experience, is likely to resort to literal interpretation of the specifications, and endless arguments ensue as to what is a straight line or a dry surface".[4] The ASCE Task Committee on Inspection of the Construction Division found, as a result of the analysis of their questionnaire on inspection, that some of the problems relating to inspec-

tors are incorrect specification interpretations, poor work habits, lack of experience, interference in the contractor's operations, bad attitudes, lack of honesty, insufficient training and low pay. Even though these problems exist 98% of the 324 contractors surveyed stated that they "welcome inspection by competent inspectors because it assures the work getting done with less change of costly errors and delays".[44] A survey of the literature proved that inspection is important, but it also was indicated that problems arise when some member of the building team fails to live up to his responsibilities.

B. Traditional Methods of Responsibility for Inspection and Quality Control

Several methods of contract administration were found in the literature. The AIA recommended in the AIAHPP that the architect be retained to perform all of the basic services. This is often done on private work.[13] In a "Reader Comment" in Engineering News Record Schweser advocated that the owner hire consultants or use his own staff to administer the contract.[45]

Representatives of the Veteran's Administration (VA), the General Services Administration (GSA), the Army Corps of Engineers (COE), and NAVFAC stated that they usually retain the designer for the design development and the contract documents services. The contract award and administration is normally performed by government personnel.[46,47,48,49] Phased construction, construction management, and turnkey are other methods of GSA contract administration.[47] The COE and NAVFAC include in most of their contracts a contractor quality control (CQC) clause (see Appendix D) calling

for the contractor to perform the quality control functions and the government personnel to interpret the contract documents and oversee the contractor's CQC program.[48,49] Smith stated that many highway departments use their own personnel to administer the inspection and quality control functions. In some cases, they have tried to protect their interests by becoming involved in the supervision of the contractor's operations.[50]

Morgan and Dean stated that the Department of Health, Education and Welfare (HEW) is involved in the administration of hospital construction contracts. A local hospital, built with federal funds, will have the normal arrangement in which the design architect of record provides the inspection as part of his contract administration duties. The Health Facilities Construction Bureau of the State Health Department will make periodic visits to the site to verify payment vouchers, to ensure that the plans and specifications are being followed, to check to see if the work meets any specific requirements of HEW, and to ensure that the applicable provisions of the Life Safety Code are met.[51,52]

The inspection and quality control on Construction Management contracts is performed by the construction manager. He is responsible for establishing an onsite staff to ensure that the work is being constructed in accordance with the plans and specifications.[53,54,55]

The model building codes outlined the procedures of the local building departments. The plans and specifications are checked to ensure that building code and related ordinances have been followed. If the plans are approved, the building permit is issued and construction is authorized. During construction the building department inspector will visit the site to inspect the work to ensure that the building code and ordinances are being met in order to protect the health, welfare and safety of the citizenry.[56,57,58,59]

C. Liability and the AIA Contract Documents Controversy

One of the most far reaching and serious problems affecting the administration of construction contracts discussed in the literature was the increased liability of architect/engineers for errors and omissions in the contract documents and for negligence to third parties.[1,60,61] The American Engineer staff wrote that between 1956 and 1966 the Continental Casualty Company experienced "heavy underwriting losses representing claims and defense costs for some 6,391 engineering and architectural policy holders".[62] For the reader to understand these legal trends a historical development of construction law will be made in the following paragraphs.

The Design Professional and Third Party Liability

Under early English law a contractual relationship had to exist between the architect and the owner for liability to be incurred by the architect. This was called privity of contract, wrote White. Privity was held to mean that "there was no liability of a contracting party to one with whom he is not in privity"

according to modern tort law (Winterbottom v. Wright). A third party is an individual not in privity of contract. As a result of the MacPherson v. Buick Motor Company case, chattels, which are an article of movable property, were removed from this protection. The court stated that if the seller knew that his product was dangerous for its intended use, he could be held liable to third parties. In recent law, according to White, courts have held that those who furnish labor or services have "an obligation of reasonable care for the benefit of third persons who might be endangered as a result of misperformance". This trend has broken down the barrier between buildings and chattels.[1]

It is written in the AIA Standards of Professional Conduct that the designer has the duty to provide the best of his ability and services. This includes a reasonably strong structure, proper materials, characteristic construction, and up to date expertise in modern improvements in the industry. During construction the owner relies upon him for certification that the building meets the intended requirements and for condemnation of unfit work. He does not guarantee a perfect plan or satisfactory results, continued White, and he is liable only for failure to exercise reasonable care and skill.[1]

White wrote that the architect/engineer deals with many people during the administration of the design and construction phases, and it is difficult not to violate the reasonable care and skill doctrine. White felt that the reason that the liability of designers had not been extended until the last forty years probably was due to this wide range of association in the administration of

his duties.[1] The members of a panel discussion in Building Construction cited the rapidly changing pace of technological development, the complexity of construction techniques brought about by new technology, and the competitive construction contracting market as reasons for this trend towards increased liability. They also said that people were the basis of the problem. Tradesmen are difficult to control and some contractors perform negligently. They continued by stating that the contractor is still solely responsible for his own performance, while the designer's primary duty is to see that the contract documents are interpreted correctly. The architect/engineer never has the final say.[63] White wrote that he can direct the manner of work, reject unfit materials, and determine material brands to be used where the specifications are ambiguous. In the case of a dispute between the owner and the contractor, he must act as an impartial arbitrator.[1]

The primary situations in which a designer can be held liable to the owner and to third parties was outlined by Sweet. Under breach of contract he can be subject to claims for design errors, inaccurate or negligent cost predictions, inadequate or derelict administration during construction, "failure to condemn defective work, improper issuance of progress payment certificates of completion, and delay in approving shop drawings submitted by the contractor". Prime or subcontractors who are not parties to the contract may place claims against the designer for failure to live up to the agreement. Most of the claims, according to Sweet, are in the area of professional negligence which he defined as "a

failure on the part of design professionals to use due care to avoid exposing others to unreasonable risks", and it can "relate to any aspect of the design professional's performance". Some specific examples are defective design and materials, negligence in any part of the design services and failure to condemn unsatisfactory work and to stop unsafe practices.[61]

The next few paragraphs will discuss a few of the cases that precipitated the contract documents controversy of the sixties. The interpretation by the courts of the two words, supervision and inspection, is at the center of the debate concerning the liability of design professionals during the design and construction phases of a project.

According to Tomson and Coplan in the Chiaverini v. Vail case in 1938 the architect/engineer was retained by the owner to supervise the construction of the project. He visited the site before and after, but never during the normal progress of the workday. The court held that he did not supervise in accordance with the meaning of the contract.[60]

In the Day v. National Radiator Corporation case in 1961, the lower court found the architect liable when a man was killed due to the architect's failure to note improper conditions during his "supervisory inspections".[1] The Supreme Court of Louisiana reversed the decision when it stated that "the approval of a shop plan authorizing the fabrication of the items in the plan did not create liability in the architect for a defective boiler, because the evidence was clear that the plan was not followed by the subcontractor who installed the boiler".[60]

The engineer was found liable to a third party in the Pastorelli v. Associated Engineers, Incorporated, case in 1959 when some newly installed duct work fell on him wrote Sweet. The contractor had nailed the duct work to the overhead rather than affixing it as specified. The engineer was found liable for not supervising the work properly because he never checked to see if the installation was correct.[61]

In the Miller v. DeWitt case in 1966, according to Tomson and Coplan, the "contractor's employees were injured from the collapse of a roof [school gymnasium] due to inadequate shoring. It was held that the architect had the duty to stop the contractor's work if he knew or should have known that the contractor's method of shoring was unsafe or hazardous".[60]

White wrote that "supervision" as it relates to the designer has been poorly understood by courts and attorneys. Supervision in the Owner-Architect agreement ordinarily means that the architect will make periodic visits to the job site. During these visits he can miss much. Courts interpret supervision to be superintendence of the work which is the contractor's function.[1] This legal development has precipitated three important factors that have affected the construction industry: liability insurance for design professionals, indemnification agreements, and change of the AIA contract documents.[1,64,65]

The Controversy Over the AIA Contract Documents

In 1961, the first of several significant changes was made in the AIA contract documents. Tomson and Coplan wrote that the pur-

pose of these changes was to "delineate the limited nature of normal architectural supervision, and thereby minimize the danger of broad judicial interpretation of such function and consequent finding of liability". The AIA felt that the words supervision and inspection had meanings that were so broad that they often misled owners and courts. The resulting changes consisted of the deletion of the word "supervision" and the substitution of "observation" for "inspection". The new clause was as follows: "The architect shall be the Owner's representative during the construction period, and he shall observe the work in progress on behalf of the owner".[66]

Parker stated that part of the argument contributing to this change was that the architect does not guarantee the contractor's performance under the contract. "Sometimes the Architect's supervisory duties are claimed, by an owner, to extend to matters wholly the responsibility of the contractor."[67] Many professionals expressed their opinions of these changes. Ross and Goldbloom felt that the change from supervise to observe weakened the design professional's position in a time when it should have been strengthened. These men thought that the consulting profession had been stripped of its "characteristic and historic responsibilities".[68,69] Tomson, Coplan, and Zaditz argued that designers must become more careful, precise, and conclusive in the terms and language of their contracts. The change to observe represented a clarification rather than a weakening.[66,70] Creegan wrote that "it is essential that an engineer not expose himself to legal responsibilities that are not his".[71]

The next revision was in 1967 and it centered over the indemnification clauses in the contract. Laurion stated that hold harmless clauses had become so unreasonable and unfair that Michigan enacted a law that voided a hold harmless clause that faulted the contractor when the liability was caused by the "sole negligence of the designer".[64] The situation had become so severe that insurance companies would not insure contractors because they interpreted the AIA General Conditions (A-201) to mean that the contractor was assuming the risks of the designer.[65]

In an article in Building Construction, the staff outlined the 1967 revision by stating that the architect is not responsibile for "construction means, methods, techniques, sequences or procedures or for safety precautions in connection with the Work, and he will not be responsible for the Contractor's failure to carry out the work in accordance with the Contract...." Note that all quoted before "and he will not be responsible" was not included in the 1961 revision. The contractor is responsible for procedures and as such the revision may help in the "allocation of liability for claims".[72]

Tomson and Coplan summarized the situation when they wrote that the trend today has been to apportion responsibility in liability suits rather than to adhere and consider the active and passive roles in the past. The supervisory architect should limit his statements to those within his jurisdiction. If both the architect and contractor are actively involved in a case of negligence, the architect is denied indemnification.[73,74]

The trend toward accountability and clarification of responsibility is changing the role of the architect/engineer. Construction related litigations have involved the design professional in more lawsuits than ever before. The result has been a re-evaluation by many members of the industry of the architect/engineer's position as an active participant during the construction phase of the project.

D. Responsibility for Inspection and Quality Control

Many articles were found that presented differing viewpoints on the issue of responsibility for inspection and quality control. The problems created by unsatisfactory inspection, liability to third parties, inadequate fees, and irresponsible building team members were cited as reasons for the re-evaluation of the traditional methods of contract administration.

The Case for the Owner

Weinberg stated that the owner's responsibilities in inspection are to determine "the level of quality he desires, needs or can afford for his project and to make adequate resources available to his designers, in terms of both money and time, so that they can prepare a proper design and provide proper acceptance inspection". The owner should not inspect and should delegate that authority to the designer, according to Weinberg.[5] This viewpoint can also be found in the AIAHPP and the MPCE.[13,14]

Schweser wrote that the owner should hire a separate consultant to inspect the work because the designer's representatives are often reluctant to question the contract documents. The designer may not catch his own errors, and some contractors are often worried about their status on future jobs.[45] Several authors feel that there would be a conflict of interest if the owner inspected his own project.

According to a survey made by the Building Research Advisory Board (BRAB) in 1968, federal agencies should inspect and supervise their own work. The BRAB cited improved quality, better control, greater economy, and more expeditious progress in construction as reasons for in-house inspection.[75] The AIA, CEC, ASCE, and ACI Committee 311 recommended in their publications that the design professional should be retained to administer the construction of the project.

Several articles in Engineering News Record have called for a revision of the codes to alleviate the problem of inadequate inspection.[76,77] In response to the recognition of the need for inspection, Milwaukee established a requirement for the owner to hire a professional engineer or a registered architect to inspect and approve the work.[77]

The Case for the Architect/Engineer

In support of inspection by the design professional, Feld stated that "inspection is the province and duty of the designer, usually delegated to a representative, as a service to protect the economic rights of the owner. He is on the job to see that the

owner receives what he has bought and, because most of the work is eventually covered from view, inspection must be provided at each step of production. Unfortunately, such inspection service is usually not provided on jobs where the need is greatest, that is, where the contractor control is minimal or even non-existent". When the responsibility is subdivided the problems with oversight, gaps and errors increase; shifting responsibility is not the answer.[36] Sweet wrote that it is traditional to furnish complete service; the designer's role affects the finished product and that means advertisement and reputation. The plans and specifications rarely express the entire design concept; therefore, supervision is necessary.[61] Uhr cited a situation in which the designer avoided mishap by catching serious errors that were missed by the inspectors.[78]

Weinberg said that the designer is the most qualified, the most familiar with the design intent and the plans and specifications, the most able man to handle adjustments during construction, and the most concerned with his good name and reputation. Inspection by the designer reduces delays and maintenance work. In short, designer inspection saves money.[27]

The arguments against designer inspection are outlined in Sweet's book Legal Aspects of Architecture Engineering and the Construction Process. The primary objection is that the compensation doesn't justify close supervision. With greater involvement, responsibility for unsatisfactory conditions increases. Sweet also stated that many design professionals are not skilled at contract administration and supervision.[61] An editorial comment in

Engineering News Record ironically said that "if 'only the designer of the structure has the initiative and desire to see that the building is constructed properly', why did North Dakota consulting engineers fight a bill that would have required consultants to supervise construction of municipally owned projects they have designed"?[79]

The AIAHPP and the MPCE both indicate that the designer should be given the responsibility to administer the construction contract as a part of his basic services provided for the owner.[13,14] The ACI Code Committee (318) stated in the Code Commentary, but not in the body of the Code, that the inspector should be the design architect/engineer of record. The ACI Inspection Committee (311) and the Structural Committee (348) said that inspection is the responsibility of the designer as a continuing function of his total responsibility to the owner.[27,80]

The responsibility for obtaining the services of a testing laboratory were found to be an integral portion of this debate. Gardner felt that by separating inspection services from the designer the result would be the destruction of the Architect - Engineer - Owner - Contractor relationship.[37] Wheeler indicated that the testing laboratory should be retained by the owner, but Weinberg believed that the only way this function could be properly handled was for it to be responsible to the architect/engineer.[8,27] A "Reader Comment" in Engineering News Record suggested that either the owner or the designer should retain the private firm. This would eliminate the deterioration of reputation caused when faulty materials, equipment and workmanship escape attention during

construction.[81]

As reported here, there is considerable literature on the architect/engineer's responsibilities in inspection. No mention was found that he had a similar responsibility for quality control. The writers either stated or implied that inspection "represents a spot check of critical items from the viewpoints of structural safety and integrity of serviceability and maintenance, performed by the design professional or his agent to check for compliance with the design".[5] This definition was found to be in keeping with the duties outlined by the AIAHPP during construction.[13] Quality control, as defined by Weinberg, "is a positive, continuous program by the contractor to assure that the material and workmanship which he and his suppliers and subcontractors furnish to the project conform to contract requirements".[5] For the purpose of this thesis quality control will be defined as a function of the contractor. Inspection can be performed by both the designer, the owner and/or the contractor.[5,8,22,27,82,83,84,85,86]

The Case for the Contractor

According to the AIA General Conditions (A-201) the contractor assumes the responsibility for "all construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the Work under the Contract". In the warranty clause (Section 4.5) he agress to perform the work using new materials and equipment, and he warrants that the "Work will be of good quality, free from faults and defects and in conformance with the Contract Documents". In addition, he agrees to be responsible for the "acts

and omissions" of his employees and subcontractors.[87]

Abdun-Nur stated that it seems logical that the one doing the work should be responsible for the quality of his work. To maintain control he must perform some level of inspection.[86] The contractor should be responsible for the control of quality, indicated Corbetta. As a member of the building team he should be trusted from the start of the job. If he is not trusted, he may not be inclined to put forth his best effort.[27] He is more apt to discover errors, omissions, negligence, and work that does not meet the requirements of the plans and specifications.[84] Zachry said that the contractor is dedicated to the art of construction, to shun mediocrity, to take pride in his work, and to maintain good relations with the architect/engineer.[88] Clothier wrote, "I cannot agree that the only proper means of assuring quality is through field supervision by the designer. This appears to be part of the attitude that contractors are not capable of (or inclined to) carrying out the intent of the plans and specifications in a proper fashion or to honestly make every effort to give the client 'what he pays for'."[22] Self inspection is the "real solution to stemming increased costs and maintaining quality", according to Zachry. It reduces rejected work and the resident engineer's efforts are welcomed as an extension of the contractor's program. Quality control is a means to an end.[88]

Zachry concluded his argument by stating that the contractor's responsibility is for the quality of the project, while the owner's is for accepting the project. By having an inspector to compliment the contractor's quality control efforts, the system of checks and

balances greatly reduces the chances of errors and omissions without creating a duplication of effort.[88]

In contrast, Wright stated that contractors are inclined to create as many benefits from the job as is possible. Superintendents and foremen, as onsite representatives of the contractor, are more interested in keeping the job from showing a deficit. The short-cuts that they take are damaging to the quality of the job.[30] An editorial in Engineering News Record supported this viewpoint by saying that due to the controlling factor of economics, there is no incentive for the contractor to provide the best inspection.[89] Tedesko indicated that due to compromises, expediencies, and short-cuts the client is often forced to accept a reduced level of quality.[31] Healy's arguments supported Tedesko's when he pointed out that the existence of high numbers of contractors have caused the quality of construction to deteriorate. The result has been a rise in costs. Labor has hurt the industry's reputation with poor workmanship and featherbedding.[28] Some writers have stated that a conflict of interest exists when the contractor controls his own quality because he is divided in his loyalty to the existing contract, future contracts, his reputation, his profit motivation, and the welfare of his subcontractors. Offner summarized this problem when he stated that "no matter how one looks at this problem, the only solution is that 'the lowest possible bidder requires the highest grade inspector'."[90]

Briggs indicated that there is a conflict of interest if the contractor selects and pays the testing agency because ethically and legally this function should be part of the designer's responsibility. One of the conclusions reached by the ASCE Inspection Committee from the analysis of their questionnaire was that "there is a general reluctance to have contractors do inspection, although a small minority see benefit in a cooperative inspection procedure using both contractor and own forces".[44]

Kein made a provacative observation when he stated that "if representatives of these industries [contractors and material manufacturers] are not interested in providing specified materials and proper workmanship in the absence of inspection, all of the inspection in the world could not guarantee the adequacy of fabrication, or construction generally. Furthermore the writer does not believe that the reputation and desire of the construction industry should be so impugned. After all, good results cannot be expected when there is mistrust between the participants in the enterprise. Competition has some force here in maintaining honesty".[29] Both Goldbloom and Weinberg indicated that quality control is the responsibility of the contractor. The assurance that the requirements of the contract documents is being achieved and the approval of the quality obtained is the responsibility of the owner.[5,82]

E. Contractor Quality Control

In November of 1961, The Armed Services Procurement Regulations (ASPR) Committee adopted a clause that was applicable to all construction projects in the Department of Defense in excess of $10,000. The clause stated that "the contractor shall (i) maintain an adequate inspection system and perform such inspections as will assure that the work performed under the contract conforms to contract requirements, and shall (ii) maintain and make available to the government adequate records of such inspections". Stephenson concluded that the ASPR clause had "only 40 words, but these words have been so misunderstood and applied with such variance, that they have caused more trouble than any new contract clause in many years".[9]

Contractor Quality Control (CQC) was first incorporated into the U. S. Army Corps of Engineer's contracts on 1 December 1966 in order to satisfy the requirements of this new ASPR regulation.[9] The Army defined CQC as "the systematic application of the methods, inspection techniques, and testing procedures required to assure that all of the materials, equipment, and workmanship conform to the contract requirements".[9]

Liebhardt said that the Corps adopted CQC because the contractor should be responsible for the quality of his work and for the control of his own operations. In many instances Corps personnel "performed inspection functions that should have been a part of the contractor's normal management system".[91] The interpretation of the 1966 program by both contractors and Corps field personnel, according to Stephenson, was that all projects would

require a separate staff of professional engineers or other highly qualified personnel to be a part of the contractor's payroll in order to fulfill contract requirements. In some cases this constituted an unreasonable demand on both the contractors and the ranks of the professional engineers.[9]

In response to this new program three articles were published in Engineering News Record that described CQC and discussed its feasibility.[92,93,94] The Consulting Engineer's Council recommended that the architect/engineers avoid bidding competitively for their services.[94] On 20 June 1967 the order was revised and clarified by the Corps. According to the revision, a separate CQC organization would be limited to special projects, and the contractor would be able to augment his inspection during special stages of the work.[9] Further definition of the roles of the government and the contractor was made in the 30 June 1971 revision.[91]

Liebhardt explained the functions and advantages of CQC when he said that the contractor must perform continuous control of his quality through the use of methods, inspection techniques, and testing procedures to ensure that his work complies with the plans and specifications. In order to safeguard the government's interests, the Corps conducts assurance activities that include verification checks, tests, and inspections to ensure that the contractor's CQC program is effectively helping him meet his obligations.[91] It is intended that through this joint effort of the government/contractor team the project will be completed at the least cost with a minimal duplication of effort.[88] An effective CQC program means that mistakes can be spotted before and close to

the time they occur, said Liebhardt. The benefit of corrections that are made quickly is savings for the contractor and the government.[91]

The Corps adopted an ambitious training program to familiarize the contractors and the government personnel with CQC, according to Liebhardt. The program has met with resistance from some contractors and reluctance to change from old methods by Corps personnel, but the adjustment period has caused a considerable improvement in these attitudes.[91] The NAVFAC re-evaluated its construction program and its relationship to the construction industry in the late 1960's, according to a historical summary in the first CQC manual. The primary area of improvement was needed in the management of NAVFAC's design and construction duties. In some cases the Navy had been attempting to control the operations of the contractor rather than encouraging him to use his ingenuity and leadership. Good contractors were being penalized through specifications that had been written to protect the Navy from the recurrence of a few unsatisfactory experiences.[10]

In March 1970, the Navy's CQC program was implemented. The NAVFAC defined CQC as "a management system established and maintained by the contractor that assures compliance with contract plans and specifications". The benefits from CQC for the Navy were outlined as the better use of personnel, fewer claims, more economic savings, and less conflicts with the contractor. There was a general feeling that the Navy would work with better contractors who would have more control of their own operations. In the event that the contractor failed to meet his obligations

satisfactorily, he could be held liable for his latent defects, gross mistakes, or fraud. As a backup, in the event that CQC failed, NAVFAC could still employ the traditional Navy Construction Inspection System (NCIS). Contractor Quality Control benefits the contractor through greater control in scheduling and execution of his work, through reduction of delays and through the use of better management practices. In short, CQC returned construction supervision to the contractor.[10]

The lower limit for CQC on contracts awarded after 1 July 1970 "to the maximum extent possible" was $1 million. It was mandatory after 1 January 1971. After a gradual reduction the lower limit was placed at $250,000 in 1973.[10] In January 1974 a new CQC manual was published which modified and clarified the existing program. With this change CQC became applicable to all contracts that are larger than $10,000.[95]

The NAVFAC CQC provisions are reproduced in Appendix D. According to the CQC contract, the contractor is required to adhere to the program in the contract documents. The Navy assumes that he has included the cost of a satisfactory CQC program in his bid and that he will follow the program in good faith. The contractor is required to provide a quality control organization which has a planned program of inspections and tests to ensure that the level of quality specified in the contract documents is being met. A CQC representative on the contractor's payroll must be on the work at all times. He cannot be subordinate to the superintendent or the project manager. He shall report to an officer of the firm. His authority to take immediate action to ensure compliance with the

contract must be clearly written in a letter signed by an officer of the construction company. The CQC plan must include, but not be limited to, the contractor's quality control organization, inspection and testing schedules, and all other aspects of the CQC program.[96,97]

The CQC representative must employ a three stage inspection program which consists of a preparatory inspection, an initial inspection, and follow-up inspections. Included in the CQC requirements is the authority to review and approve all shop drawings, catalog cuts, samples, and other related items unless otherwise noted. Periodic inspection reports must be submitted to the Navy.[96,97]

The NAVFAC General Conditions outline the Navy's responsibilities for CQC. The primary duty of the contract administrator is to assure himself that the contractor's CQC program is operating effectively. In addition, he verifies payment vouchers and performs acceptance inspections. He is authorized to conduct any tests and inspections that he feels are necessary to satisfy himself that the conditions of the contract documents are being achieved. If the Navy finds that the CQC representative is unsatisfactory, it can require the contractor to replace him.[96,97]

The first CQC manual was a combination of instructions and presentations that gave the field personnel very general guidance in the administration of this program. Several of the Engineering Field Divisions (EFD) of NAVFAC recognized the need to provide more detailed guidance to their own personnel. As a result, they issued their own instructions which included policies, sample forms and

plans.[98,99] All of these instructions were superseded by the 1974 manual.

In January 1974 NAVFAC defined its CQC policies in a new manual according to three contract categories. These three categories are large (greater than $500,000), medium ($50,000 to $500,000) and small ($10,000 to $50,000). On large projects, construction is authorized prior to the approval of the complete CQC plan. On small and medium projects the letter plan and the complete plan respectively must be approved prior to the start of construction. On both small and medium projects the superintendent may also handle the responsibilities of the CQC representative. Large projects must have a separate CQC organization and representative. A daily report is required on large and medium projects. In order to reduce the amount of paperwork, a weekly report is required on small jobs.[95]

Submittal approval, according to the new manual, will remain unchanged for large and medium contracts, but for small jobs the Navy retains the right to approval in areas that the contractor may not have the necessary expertise available. It is recommended that consultants or the home office approve submittals rather than the onsite CQC representative.[95]

The new manual outlined the "corrective measures" that are available to the contract administrator in the event that the contractor does not comply with the plans and specifications. Among these measures were "removal and replacement of defective materials and workmanship, withholding payment, removal of incompetent CQC personnel, stopping the work, appraisal of the contractor's

performance, and termination. Implementation of any enforcement action requires careful consideration, and complete and timely documentation".[95]

The Navy provided extensive training programs to promote the acceptance of CQC and to facilitate its implementation. Since 1970 it has been used on millions of dollars of contracts in the Navy. It was adopted as a new method of contract administration in an effort to solve some of the problems the Navy had experienced. The effectiveness of this program and its applicability to civilian construction is the topic of the following chapters.

CHAPTER III

RESEARCH TECHNIQUES AND COLLECTION OF DATA

Contractor Quality Control (CQC) is a controversial method of contract administration. Some feel that it gives the contractor too much responsibility and as such represents a conflict of interest. The other viewpoint is that it is a positive method of encouraging the contractor to manage his own operations in order to maintain the level of quality that is specified. This means that the inspector becomes less involved in the contractor's operations, which gives him more time to cover all of the work and to serve as a team member, complimenting the efforts of the contractor.

When a contractor signs a contract that contains CQC provisions he is committed to an active program of quality control. The complete expertise of his organization is expected to work for the goal of providing the level of quality that was agreed when the contract was signed. The representative of the owner called the contract administrator retains the responsibility for interpreting the plans and specifications, for approving progress payment vouchers, and for accepting the work. He also makes periodic visits and tests to ensure that the contractor's CQC program is functioning properly. The basic responsibilities as outlined in the AIA General Conditions for the contractor and architect are not unlike this explanation of CQC. The contractor is no more responsible for the quality of his job under CQC, but the contract

states that he will take a more active role in the control of that quality. Contractor Quality Control makes official what many good contractors and owner's representatives have been doing for years.

The Navy has been incorporating CQC in many of its contracts since 1970. The Naval Facilities Engineering Command did not publish a complete CQC policy until January 1974. The lack of uniformity in the administration of these contracts in the Navy was the primary reason for this new policy. The author has observed this nonuniform level of contract administration in different Resident Officer in Charge of Construction (ROICC) Offices; their varying concepts and degrees of participation in the administration of the contracts has been reinforced through correspondence from other offices.

Variations in the understanding of Contractor Quality Control presents some interesting questions. Are the attitudes, opinions and biases of the contract administrators causing a difference in the involvement by the representatives of the owner? Is CQC a satisfactory method of achieving quality? Is the contractor more inclined to accept his responsibility for the quality of his job in a program of this nature? The Navy's active CQC program provided an excellent basis for a study on this subject.

The major research technique utilized in this study was that of an opinion survey by questionnaires. The purpose of the questionnaire was to establish the cross-section of attitudes concerning CQC and its effectiveness as a method of contract administration represented by architect/engineers, contractors, CQC representatives, and Navy personnel. Interpretation of the responses

was facilitated by personal interviews at two Navy contract administration offices and with several contractors and designers.

The Questionnaire

A questionnaire must be long and complete enough to provide the right information. It must also be easy for the recipient to read and answer without being very time consuming. Questionnaires have been used extensively in the United States, and they are often discarded when received. It must be readable, short, and be accompanied by a good letter of introduction that obtains enough of the businessman's interest to make him want to fill it out.

Appendices A, B, and C contain the four types of questionnaires and the cover letters that were used in this study. Two of the forms were sent to Architect/Engineers and Contractors (referred to as "civilian respondents") in order to determine the feasibility of using such a program in nongovernment contracting. The forms are similar and are worded to make the questions applicable to the recipient. The other two types of questionnaires were sent to Contractors who have had experience with the Navy's CQC program, to CQC representatives, and to Navy personnel (referred to as "Navy related respondents"). These forms were designed to emphasize the factors most important in analyzing the Navy reaction to CQC. Several similar questions were asked in all of the forms in order to compare the attitudes of all of the respondents concerning inspection, quality of work provided by contractors, and CQC.

Responses were categorized on the basis of several initial questions indicating the respondent's professional position (i.e. Company President, Construction Representative, etc.), business classification, annual contract award volume, and the types of work performed. The initial two questions asked of the civilian and Navy related respondents were designed to define the time requirements for "satisfactory" inspection in terms of hours per week; they were also asked who should perform those inspections. The inspection function was divided into four basic categories:

1. Interpretation of Plans and Specifications - those steps taken to interpret and define the intent of the contract documents in reference to possible errors and omissions.

2. Quality control inspection - those activities taken to ensure that the work and materials meet the requirements of the contract plans and specifications.

3. Job progress inspection - a periodic check to determine the progress of the work for such purposes as approval of payment vouchers, scheduling, and other needs as determined by the one performing or requesting the inspection to be made.

4. Final acceptance inspection of the work - an inspection of the work when substantial completion has been made for the purpose of establishing a punch list of items to be completed and for final payment.

All of the respondents were asked questions in five basic categories. The status of inspection questions discussed designer and Navy regard for inspection and the frequency that they provide satisfactory inspection in several categories (i.e. Mechanical,

Electrical, Job Progress, etc.). In the category of the effectiveness of inspection, questions were asked concerning its desirability as a service, its use as a tool to find mistakes, and its potential for ensuring quality. The opinions of the level of quality that contractors provide according to typical contract sizes were discussed; a section on the amount of work that contractors redo was included. For the Navy related respondents important areas of CQC were included to establish their opinions. The mechanics of CQC such as the CQC plan and the three stage inspection program, its potential benefits such as increased productivity and control, and the desire to retain or delete the CQC provisions as part of the contract were all included in this section.

The civilian respondents were asked if they wanted a program such as CQC in their contracts. For those who did, further questions were asked such as what responsibilities they would want the contractor to have under those circumstances. All of the respondents were asked basic questions concerning contractor inspection; these included construction management, conflict of interest, and past experience with CQC. Comments were requested at the end of the questionnaire.

Development work was done on perfecting the questionnaires with the aid of local contractors and members of the faculty of the Department of Civil and Environmental Engineering at the University of Colorado. After receiving and analyzing these questionnaires to ensure that the necessary information was being received, changes were made and the forms were printed for distribution.

The cover letters (see Appendices A, B, and C) were carefully worded and included the proper references. The survey sample consisted of randomly selected names from lists furnished by the Navy and the AGC Constructor Directory (1973-1974). Many of the recipients were contacted in order to ensure a good response. The size of the survey sample and response is shown in Table I. The return of 62.5% of the questionnaires was a very favorable indication of the interest and cooperation that exists in the construction industry.

The Analysis

The data was subdivided into groups for the purpose of analysis. The five basic categories (Navy related: CQC representative, Navy personnel, and CQC Contractor; Civilian: Architect/Engineer and Contractor) represent the potential polarizations of different opinions on CQC. These categories were further classified according to their response to the question concerning their preference for having CQC as part of the contractual requirements (Question 8 - civilian forms; Question 11 - Navy forms). This breakdown can be seen in Tables II and III. For clarification, the "CQC Contractor" is a civilian contractor who has previously had Navy CQC Contract experience and was sent the Navy CQC evaluation questionnaire.

The information from the questionnaires was tabulated for each question and various combinations of these questions utilizing the ten respondent classifications were analyzed. This information was evaluated with the background aid of the personal interviews and of

Table I

Questionnaire Returns

Category	Mailed	Returned	% Returned
Architect/Engineer	60	37	62
Contractor	50	27	54
Navy	72	54	75
CQC Representative	24	12	50
CQC Contractor	50	30	60
Total	256	160	63

Table II

Question 8 Breakdown of Questionnaire Returns (Civilian)

Civilian Questionnaires			
Category	Respondents Replying Yes to Question 8 (Yes to CQC)	Respondents Replying No to Question 8 (No to CQC)	Total
Architect/ Engineers	10	27	37
Contractor	12	15	27

Table III

Question 11 Breakdown of Questionnaire Returns (Navy Related)

Contractor Quality Control Questionnaire			
Category	Respondents Replying No to Question 11 (Retain CQC in Contract)	Respondents Replying Yes to Question 11 (Delete CQC from Contract)	Total
Navy	26	28	54
CQC Repre- sentative	10	2	12
CQC Contractor	19	11	30

correspondence to produce the results in the following chapter.

CHAPTER IV

SURVEY RESULTS AND DISCUSSION

This chapter is divided into seven sections which are defined in Tables IV, V, and VI. Sections one, four, and seven will contain a general analysis of the groups as defined in the tables. A further breakdown will be made according to the replies of each group to the question concerning contractor quality control. At the end of this chapter the data will be summarized, and it will include a discussion of the feasibility of CQC in both the Civilian (nongovernment) and the Navy construction markets. A complete tabulation of the questionnaire responses is included in the Appendix. Wherever applicable, a portion of the data will be presented in this chapter to illustrate the result being discussed.

Section 1. Architect/Engineer and Contractor Respondents

This section consists of an analysis of the responses from all of the architect/engineers and contractors. The number of respondents in both groups can be found in Table IV.

In order to establish the overall attitude of the respondents toward inspection and its relative importance, the four questions presented graphically in Figures 1, 2, 3, and 4 were analyzed. The designer respondents have a higher opinion than the contractors of the regard that other architect/engineers have for inspection. This is shown in Figure 1. It is significant that the contractors with a somewhat lower opinion (more in the often than always

Table IV

Questionnaire Analysis Sections:
Architect/Engineers and Contractors

Analysis Sections	Response to Question Eight[1]	Bar Graph Notation[2]	No. Respondents In This Group
Section One: General Analysis			
Architect/Engineer	Yes and No	A/E	37
Contractor	Yes and No	C	27
Section Two: Comparative Analysis			
a. Architect/Engineers who do not want the Contractor to have the sole responsibility for inspection.	No	N	27
b. Architect/Engineers who want the Contractor to have the sole responsibility for the inspection.	Yes	Y	10
Section Three: Comparative Analysis			
a. Contractors who do not want the sole responsibility for the inspection.	No	N	15
b. Contractors who want the sole responsibility for the inspection.	Yes	y	12

Note:

1. Would you prefer to have the option of a quality of construction clause which has incorporated into it a warranty of construction provision where:
i) the contractor had full responsibility for the inspection services with an extended warranty period, and
ii) the owner/designer had the responsibility for payment, periodic checks to ensure that the contractor's inspection program is functioning properly, and final acceptance of the completed job? (check one) ____Yes; ____No

2. Bar Graph Notation: In the body of the text bar graphs will be included to illustrate the distribution of the responses in percentages. In each section the two groups will have the notation shown in this table which will facilitate the comparative analysis.

Table V

Questionnaire Analysis Sections: Navy Related Respondents

Analysis Section	Response to Question Eleven[1]	Bar Graph Notation[2]	No. Respondents In This Group
Section Four: General Analysis			
Navy Personnel	Yes and No	N	54
CQC Contractor[3]	Yes and No	Q/C	30
CQC Representative	Yes and No	R	12
Section Five: Comparative Analysis			
a. Navy personnel who want to delete the CQC provisions from the contract and return to NCIS[4].	Yes	Y	28
b. Navy personnel who want to retain the CQC provision as part of the Navy Contracts	No	N	26
Section Six: Comparative Analysis			
a. Contractors who want to delete the CQC provisions from the contract and return the responsibility for the inspection to the Navy.	Yes	Y	11
b. Contractors who want to retain the CQC provisions as part of the Navy Contracts.	No	N	19

Note:

1. Would you prefer to have the Navy perform the inspection & delete the CQC provisions from your contract? (check one) ___Yes; ___No.
2. See Note (2) Table IV.
3. A CQC Contractor is a civilian contractor who has had CQC experience and was sent a CQC questionnaire.
4. NCIS is the Navy's acronym for a non-CQC project in which the Navy has the sole responsibility for the inspection.

Table VI

Analysis Section of All Respondents

Definition of Analysis Section	Response to Question 8 or 11[1]	Bar Graph Notation[2]	No. Respondents In Each Group Classification
Section Seven: General Analysis			
Architect/Engineers	Yes and No	A/E	37
Contractor	Yes and No	C	27
Navy Personnel	Yes and No	N	54
CQC Contractor	Yes and No	Q/C	30

Note:

1. The analysis in this section is based upon total responses rather than a breakdown according to the Yes/No responses to Question 8 and 11 responses.
2. See explanation for Note (2) Table IV.

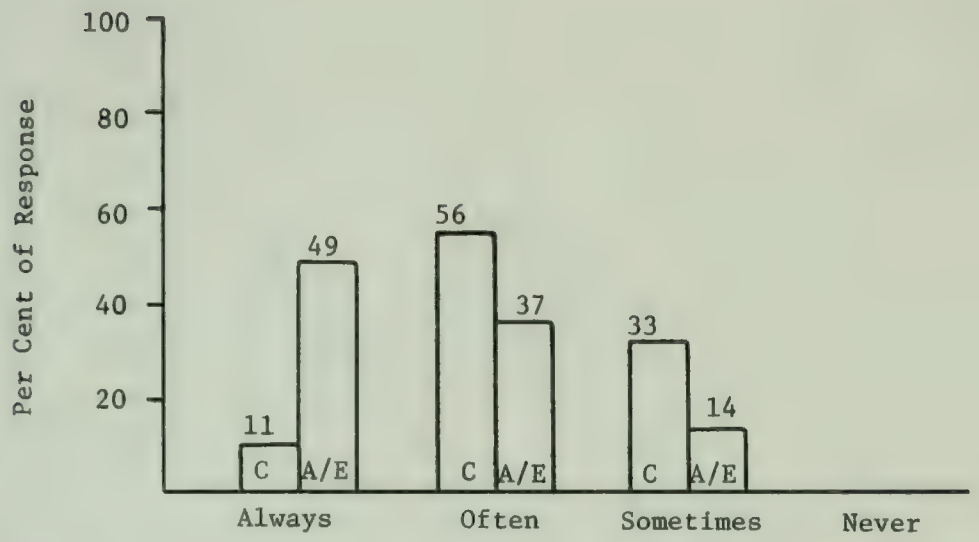


Figure 1 Architect/Engineer and Contractor Responses to Question 3a. In your opinion, have the Designers that you have worked with had a good regard for inspection?

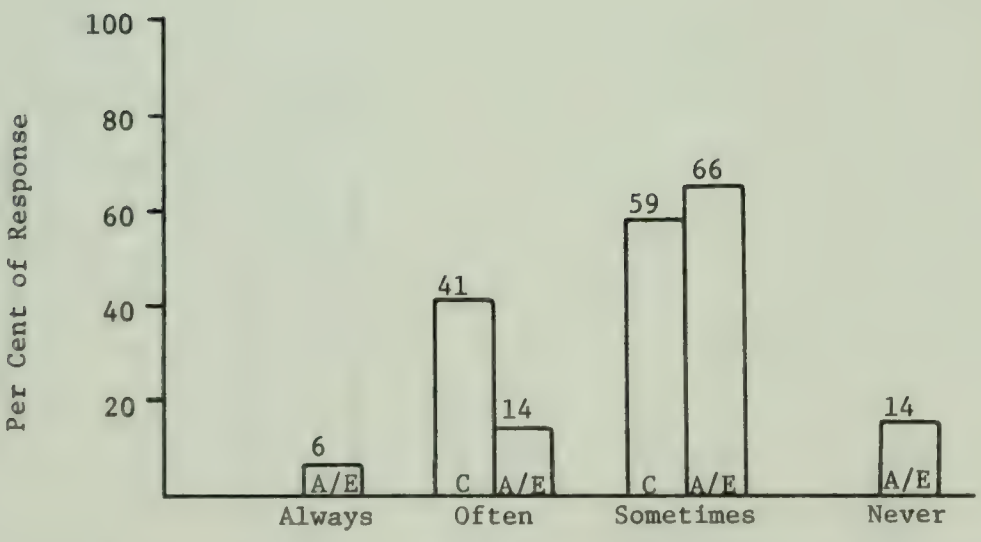


Figure 2 Architect/Engineer and Contractor Responses to Question 3b. In your opinion, have the Designers that you have worked with used inspection to get work that is not clearly shown in the Plans and Specifications?

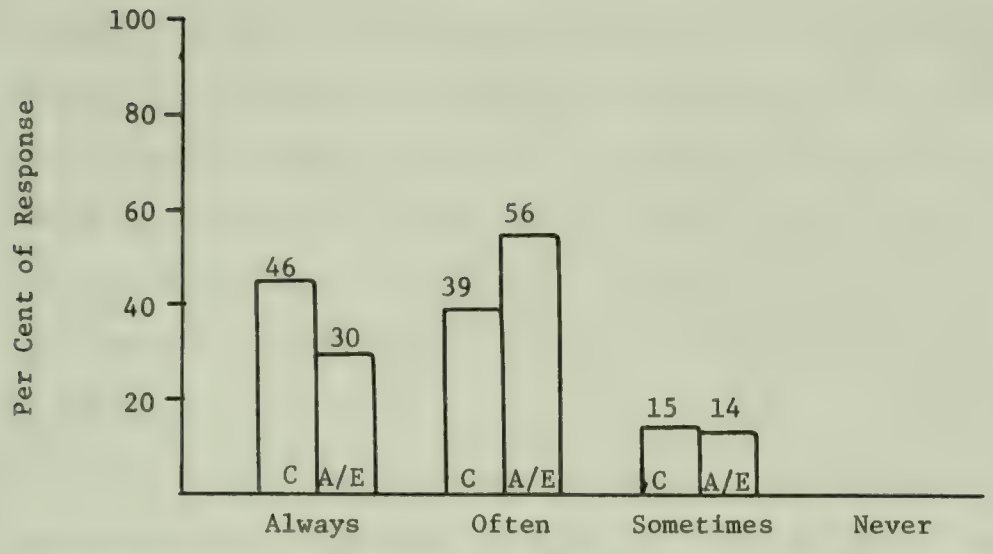


Figure 3 Architect/Engineer and Contractor Responses to Question 4b(i)/4a. Do you feel that good inspectors are difficult to find?

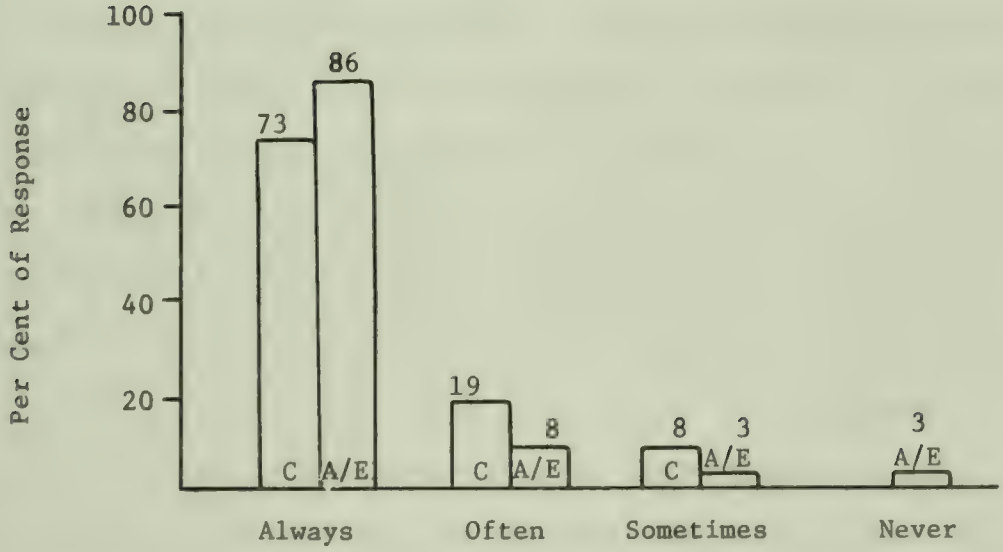


Figure 4 Architect/Engineer and Contractor Responses to Question 4b(v)/4d. Do you feel that inspection is a service that you like to have on your job?

category), do believe that designers "often" have a good regard for inspection. From the second figure it can be seen that contractors have a greater tendency to feel that designers use inspection to obtain work that is not clearly shown in the contract documents. Both contractors and designers agree that well qualified inspectors are difficult to find and that inspection is a service that they always like to have on their jobs. This agreement to the questions in Figures 3 and 4 could be based on different reasons in that inspection normally achieves separate goals for each group. The importance of this service obviously is recognized in the construction industry.

By asking the respondents to state the frequency with which architect/engineers have provided satisfactory inspection in several categories, some further trends can be seen. The relative levels are presented in Table VII. The contractor and designer respondents tended to indicate that the same types of inspection had been satisfactorily provided in a similar order of rating, except for the highest category. The architect/engineers felt that they provided interpretation of the plans and specifications the most satisfactorily while contractors indicated that job progress inspection was the best. Both groups rated quality control inspection highly, but clearly it is not the primary purpose of inspection. These responses are important when considered in light of CQC contract administration. The emphasis placed on the various categories is probably a factor in the manner in which they were rated. Design intent would appear to be the primary purpose

Table VII

Ranking of the Inspection Categories in Questions 3c thru 3i from the Responses of Architect/Engineers and Contractors

(Question 3c thru 3i: In your opinion, have the Designers that you have worked with provided satisfactory...?)

	Architect/Engineer	Contractor
1.	(Highest) Interpretation of the Plans and Specifications	Job Progress Inspection
2.	Final Acceptance Inspection	Final Acceptance Inspection
3.	Quality Control Inspection	Quality Control Inspection
4.	Structural	Interpretation of the Plans and Specifications
5.	Job Progress Inspection	Structural Inspection
6.	Electrical Inspection	Electrical Inspection
7.	Mechanical Inspection	Mechanical Inspection

of inspection for designers, while certification of the work for payment is considered the most important by contractors.

The consideration of cost and the attitudes of the owner in reference to inspection are represented in Figures 5 thru 8. As discussed in the literature review, the owner's attitudes concerning quality control and inspection and his willingness to pay for these functions is an important consideration to the designer and the contractor. It can be concluded from the designer responses illustrated in Figure 5 that owners are "often" willing to pay for inspection, implying that there is no serious problem in this area. In Figure 6, the responses of the designer are primarily in the "always/often" categories which implies that owners are aware of the importance of inspection. When Figures 5 and 6 are compared it can be concluded that owners are more aware of the importance of inspection (always: 40%) than they are willing to pay for it (always: 17%).

The designers indicated that inspection normally costs in the range of two percent of the total contract award price. Seventy percent of the designers do not feel that inspection is ever too expensive to provide (Figure 7) while the contractors have indicated that it is "sometimes" too costly. Contractors and architect/engineers are remarkably close in their responses to the question that asked if satisfactory inspection reduces the cost of construction for the contractor. There is no conclusive concentration of the data in any one category, but it can be concluded that both groups feel that it does reduce costs the majority of the time.

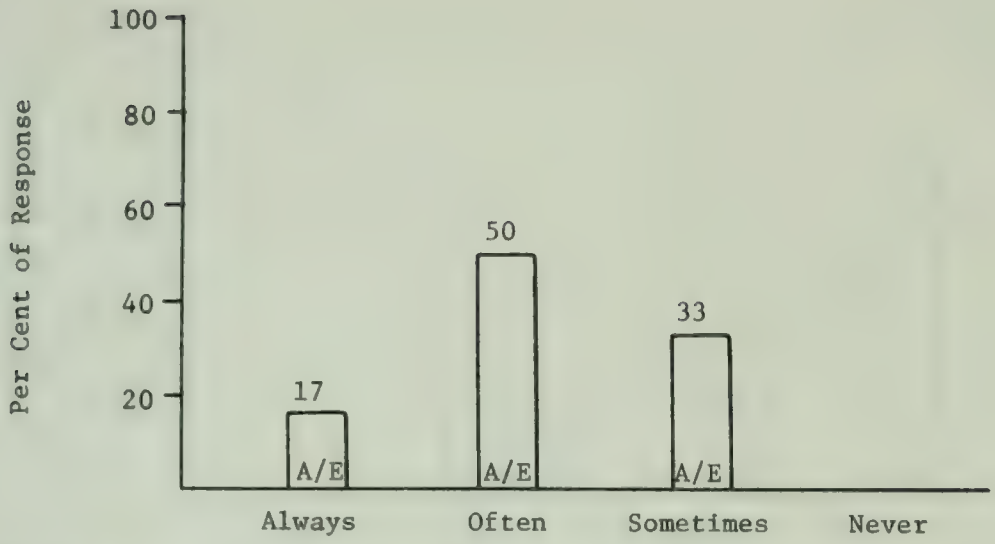


Figure 5 Architect/Engineer Responses to Question 4b(vi). Do you feel that owners are willing to pay for satisfactory inspection?

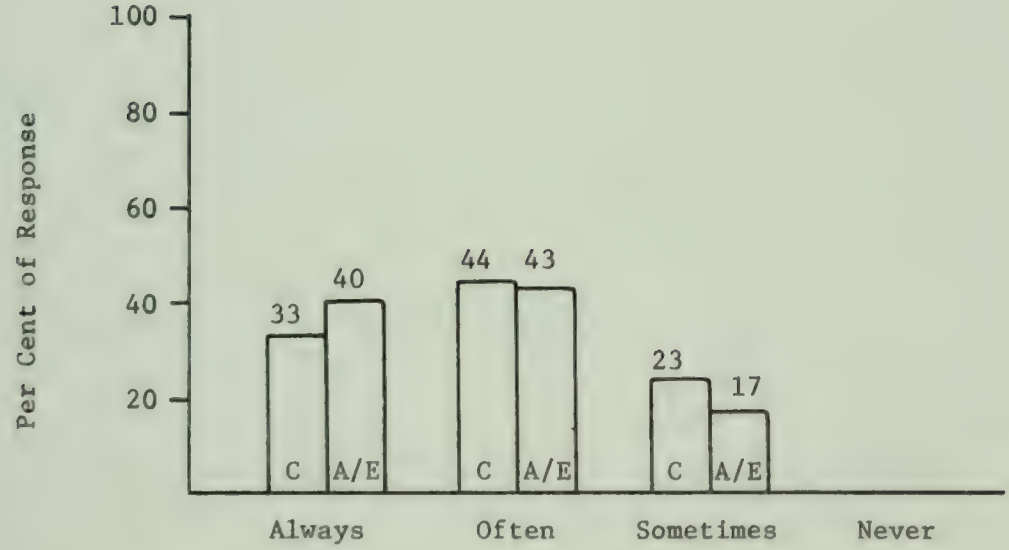


Figure 6 Architect/Engineer and Contractor Responses to Question 10b. Do you think that owners feel that inspection is important to the quality of the job?

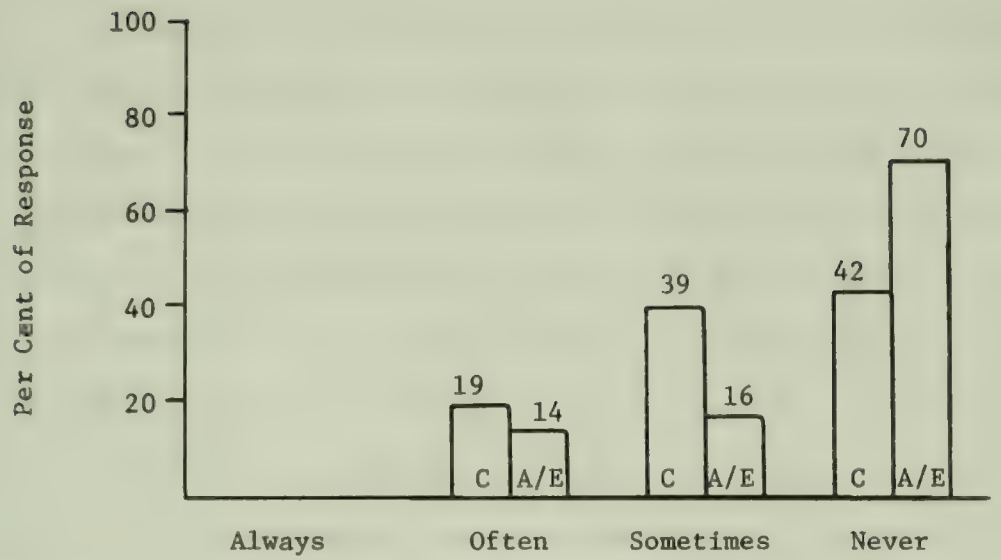


Figure 7 Architect/Engineer and Contractor Responses to Question 4b(iv)/4e. Do you feel that the cost of "satisfactory" inspection is too expensive to provide?

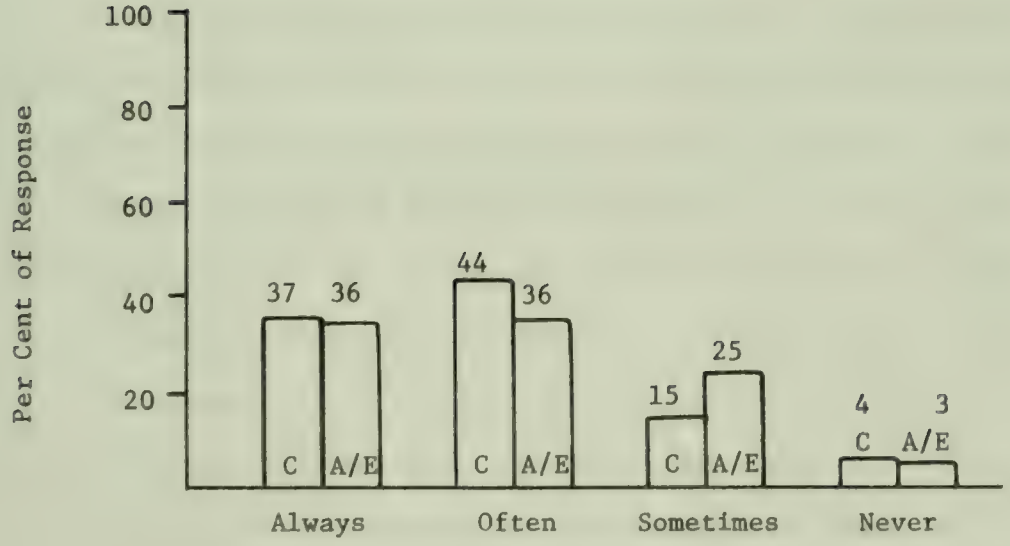
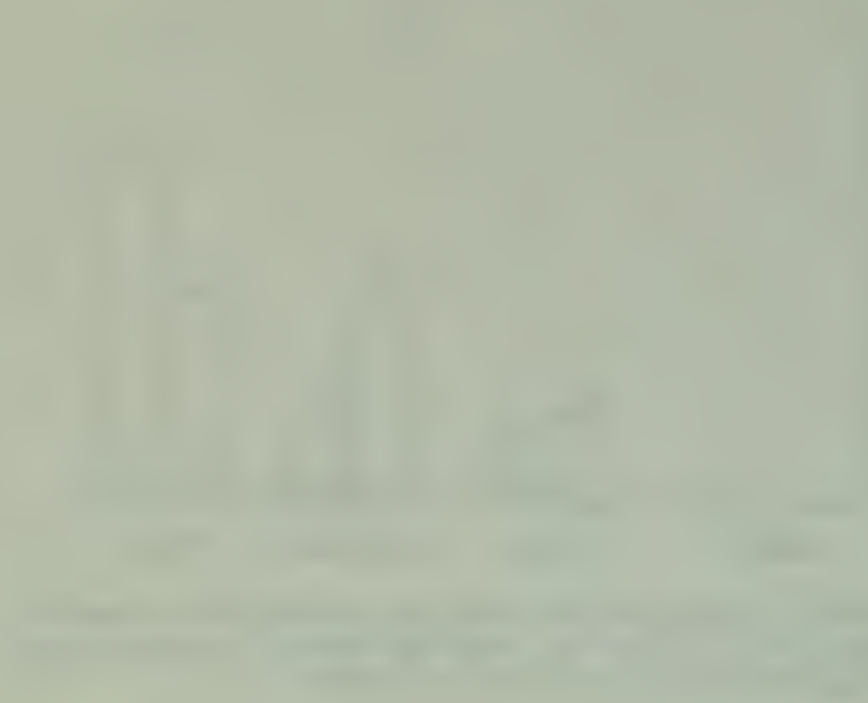


Figure 8 Architect/Engineer and Contractor Responses to Question 10a. Do you think that satisfactory inspection reduces the cost of construction for the contractor?



The designers see inspection more as a tool to ensure that the contractor complies with the plans and specifications (see Appendix H) than as a method of finding mistakes. This could be one of the reasons why the designers had the most favorable opinion of their interpretation of the contract documents (see Table VII). It can be concluded from Figure 9 that there are differing opinions as to whether contractors really welcome inspection. The contractors have indicated that inspection is more of an aid to construction through finding mistakes than to ensure that the contractor complies with the contract documents. The contractor respondents want inspection on their projects more than the designers believe that they do. This dual opinion about the purpose of inspection is an important conclusion because it illustrates that the building team members actually have different viewpoints.

When asked who should be responsible for the inspection both groups of respondents indicated that the designer and/or his representative should have that duty (see Tables VIII and IX). Only a few contractors believed that they should have the responsibility for the inspection. It can be concluded from Table X and Figure 10 that projects less than $500,000 require a much higher relative cost for inspection. Contractor and architect/engineer responses are remarkably close for projects larger than $500,000. The high levels of inspection required for smaller projects which are indicated by both groups might make the cost of CQC much less attractive on contracts less than $500,000. The responses from the contractor represent a desire to take more responsibility in the functions of inspection and quality control on some contracts. On large

Figure 9 Architect/Engineer Responses to Question 10c. Do you think that Contractors welcome satisfactory inspection?

Table VIII

General Results of Architect/Engineer and Contractor Responses to Question 2. Responsibility for Inspection and Quality Control

(Who should perform the inspections mentioned in Question (1)? Please enter below the appropriate number from the following categories: (1) Architect (part time); (2) Architect ("clerk of the works"); (3) Engineer (part time); (4) Engineer ("clerk of the works"); (5) Contractor; (6) Design Engineer contracted by the Architect; (7) Other (specify)).

	Responsibility Category			
Respondents	Designer	Contractor	Shared: Designer and Contractor	Total No. Responses
Designer	383	1	1	385
Contractor	244	23	39	306

Table IX

Breakdown of Contractor Responses to Question 2 in the Sole and Shared Responsibility for Inspection Categories

Inspection Category	Contractor Sole Responsibility	Shared Responsibility: Designer & Contractor
Interpretation of the Plans & Specifications	3	5
Quality Control Inspection	12	16
Job Progress Inspection	7	12
Final Acceptance of Each Stage of the Work	1	6

Table X

Architect/Engineer and Contractor Responses to Question 1.
Inspection Time Requirement in Hours Per Week.

(Question 1: What is the frequency in the four areas noted below of the total amount of inspections (excluding municipal building inspections) that you would define as satisfactory. Answer in the job size columns that apply to your company considering the type of work that you do. (Enter frequency: ie, as needed, 1 hr/wk, fulltime, none, etc.)).

	Up to $100,000		$100,000 to $500,000		$500,000 to $1 Million		$1 Million to $3 Million		$3 Million and Greater	
	Contractor	Architect/ Engineer	Contractor	Architect/ Engineer	Contractor	Architect/ Engineer	Contractor	Architect/ Engineer	Contractor	Architect/ Engineer
Interpretation of the Plans/Specifications	6.3	2.7	2.3	4	10.7	6.3	12.5	11.2	22	22.2
Quality Control Inspection	6.5	11.8	7.5	10.3	16.8	18.6	24.5	25.1	34.9	30.8
Job Progress Inspection	6.1	7.5	5.8	6.4	8.1	13.9	9	18	23.8	24
Total Inspection Time Requirement (hours/ week)	13.9	22	15.6	20.7	35.6	38.8	46	54.3	80.7	77

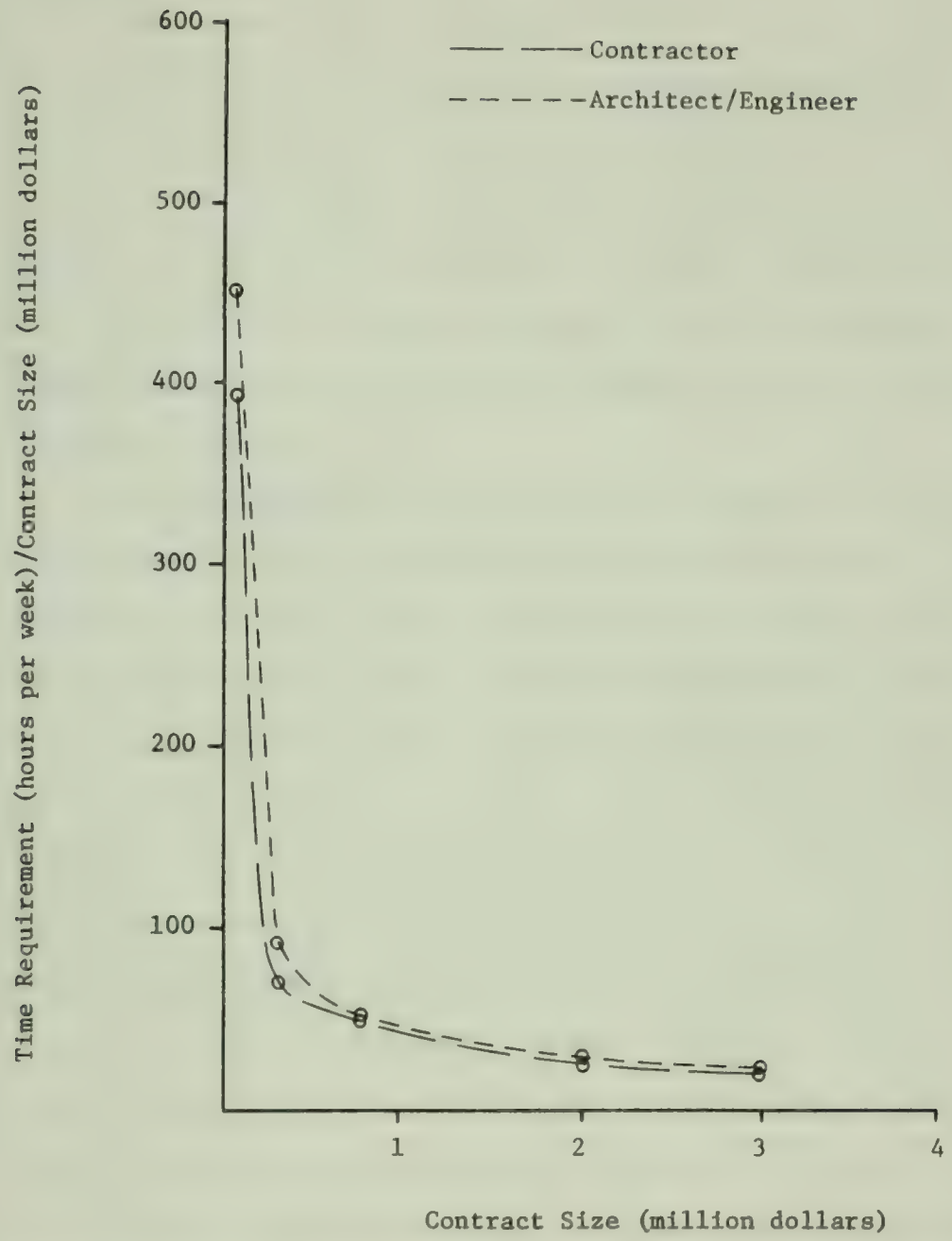


Figure 10 Architect/Engineer and Contractor Responses to Question 1. Inspection Time Requirement as a Function of Contract Size.

contracts this desire could help to make CQC successful.

It can be concluded from Figure 11 that it is the opinion of the designers that the contractor should "always" be responsible for the quality of his job, but the contractors are not as inclined to agree. The AIA General Conditions state that the contractor warrants that the work will conform to the level of quality specified. Only 65% of the contractor responses were in the always category which implies a low level of disagreement with the standard warranty clause.

The architect/engineers feel that most contractors provide a level of quality that is equal to that specified on contracts larger than $500,000 per award (see Table XI) which might explain the disproportionate levels of inspection recommended for contracts in this range (see Figure 10). They also believe that they require the contractor to redo more work than he does on his own initiative (see Figure 12 and 13). The contractor respondents indicated that contractors provide work that is equal to the quality specified on contracts greater than $100,000. Their opinion is that they redo more work on their own initiative. This is consistent with the higher response obtained in the category labeled "level of quality that is better than the plans and specifications" in Table XI.

It can be concluded from Figure 14 that the architect/engineer respondents are against the contractors having the sole responsibility for the inspection three to one while the contractors are divided on this subject. The opinion of the designers is that CQC represents a conflict of interest and that the contractor can "never" inspect the work better than the architect/engineer (see

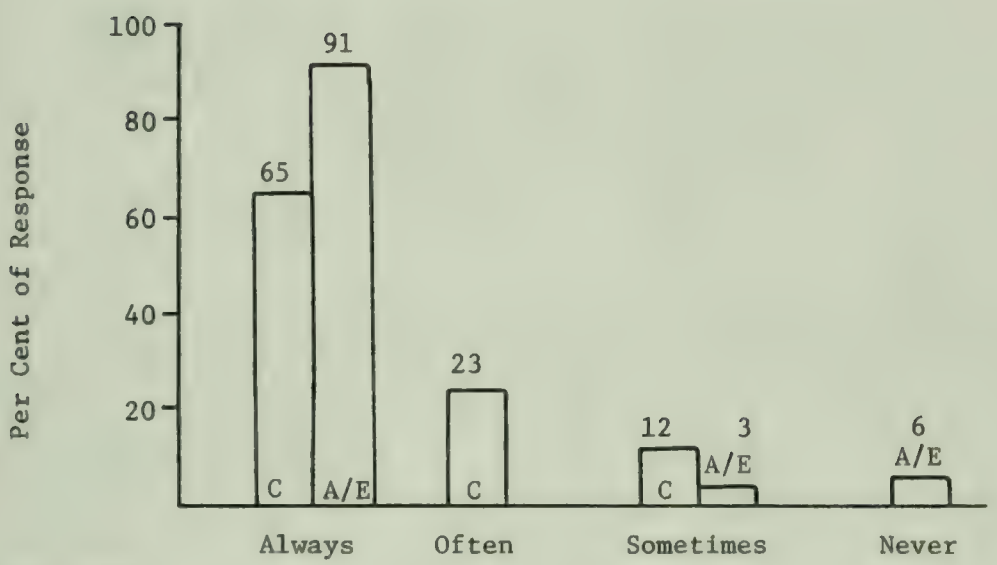


Figure 11 Architect/Engineer and Contractor Responses to Question 10f/g. Do you think that the Contractor should be responsible for the quality of his job?

Table XI

Architect/Engineer and Contractor Responses to Question 7/5

To your knowledge, do contractors in the following categories have a tendency to provide:

	a) Just enough Quality Control to get by		b) Level of Quality Control that is required by Plans & Specifications		c) Level of Quality Control that is higher than (b) to enhance company reputation		Total # Responses	
	Contractor	A/E	Contractor	A/E	Contractor	A/E	Contractor	A/E
Up to $100,000 per award	10	23	6	4	-	-	16	27
Up to $500,000 per award	4	21	12	8	2	-	18	29
Up to $1Million per award	-	14	13	15	7	-	20	29
Up to $3Million per award	1	11	10	16	6	6	17	33
Unlimited per award	1	10	12	13	9	6	22	29

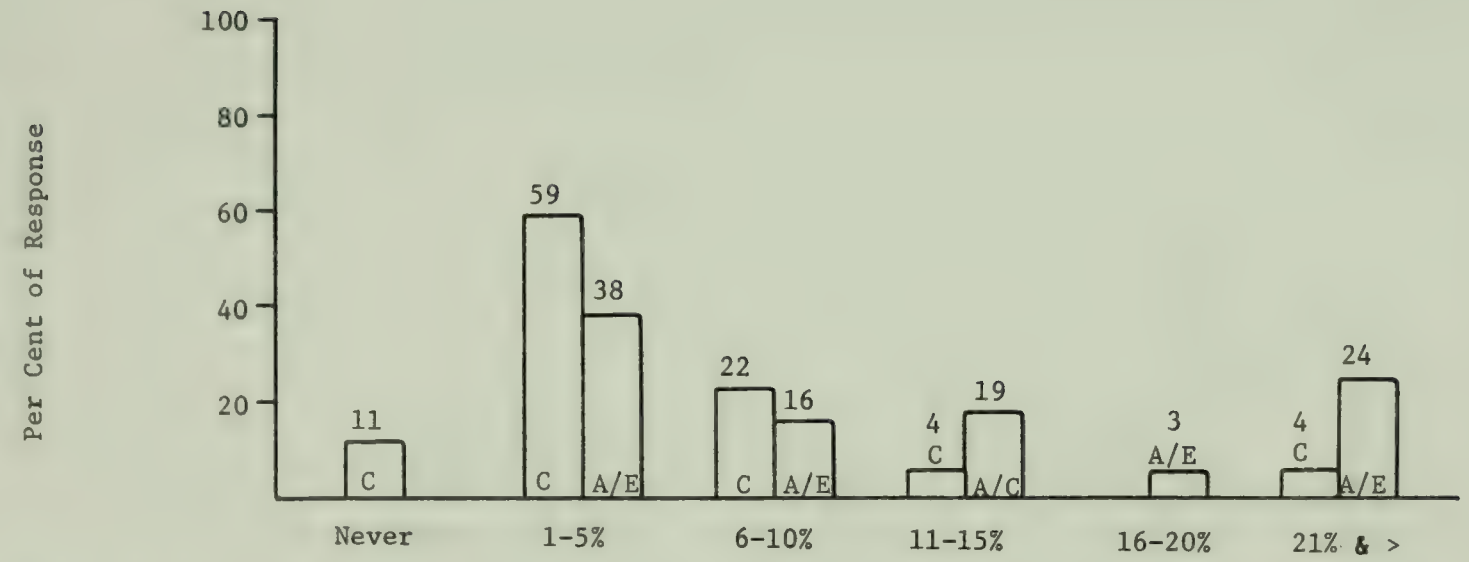


Figure 12 Architect/Engineer and Contractor Responses to Question 5/7. How often does the Architect require you (contractor) to redo work because it is not satisfactory?

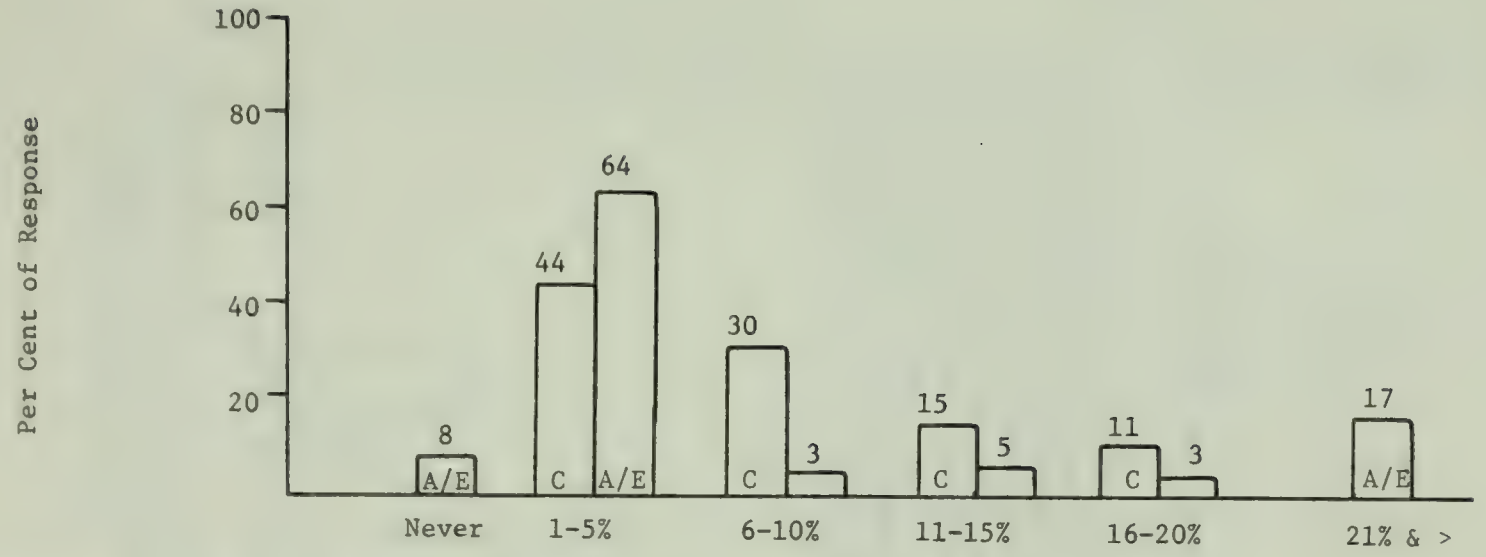


Figure 13 Architect/Engineer and Contractor Responses to Question 6. How often does the contractor on his own initiative require his forces to redo work that is not satisfactory?

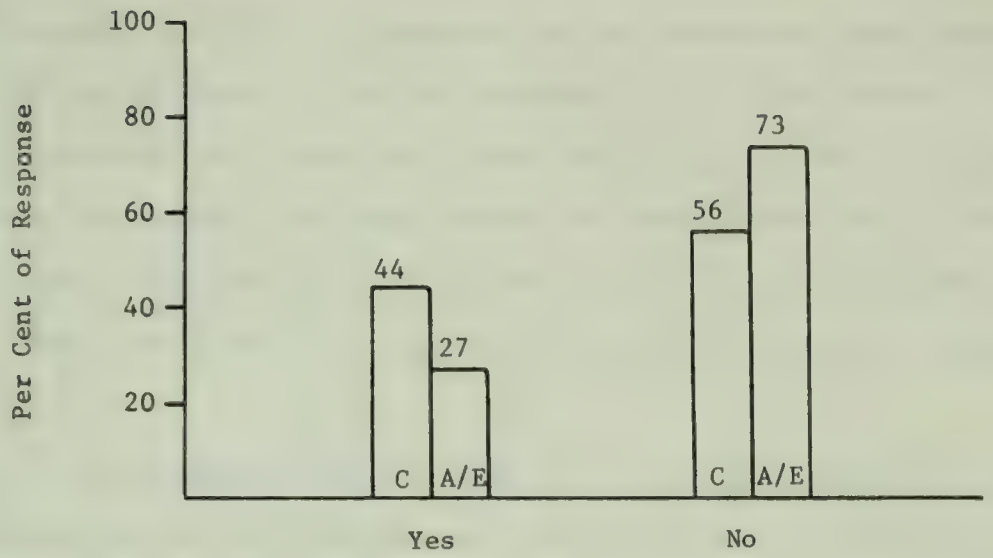


Figure 14 Architect/Engineer and Contractor Responses to Question 8. Would you prefer to have the option of a quality of construction clause which has incorporated into it a warranty of construction provision where:
i) the contractor had full responsibility for the inspection services with an extended warranty period, and
ii) the owner/designer had the responsibility for payment, periodic checks to ensure that the contractor's inspection program is functioning properly, and final acceptance of the completed job? ____Yes; ____No.

Figure 15 Architect/Engineer and Contractor Responses to Question 10d/c. Do you think that the contractor can have the sole responsibility for inspection and properly inspect a job better than the designer?

Figures 15 and 16). In contrast, the contractors are more favorably inclined towards CQC than the designers. It is the opinion of the contractors that "sometimes" there would be a conflict of interest and that usually they could inspect the work better than the designer. The respondents indicated that construction management "often" lends itself to contractor inspection, as shown in Figure 17.

The architect/engineers and the contractors responding to the questionnaire have demonstrated that inspection is an important facet of the construction industry. Each group holds a lower opinion of the other which is understandable due to their difference in responsibilities in the construction process. Architect/engineers are the representatives of the owner and must ensure that he is getting the most for his construction dollar. The design intent must be achieved in construction in order to accomplish this goal. The contractor normally tries to provide the most quality for the least amount of money. To him the acceptance and payment for his work is necessary in order for him to furnish that quality.

The contractor respondents have indicated that satisfactory inspection is an aid to the insurance of quality in construction. This, in part, is accomplished through reduced costs and discovery of mistakes. They are motivated by profit, and yet they see themselves as responsible members of the building team. The architect/engineer respondents see themselves as the representatives of the owner. When the interests of these two groups are merged, as in

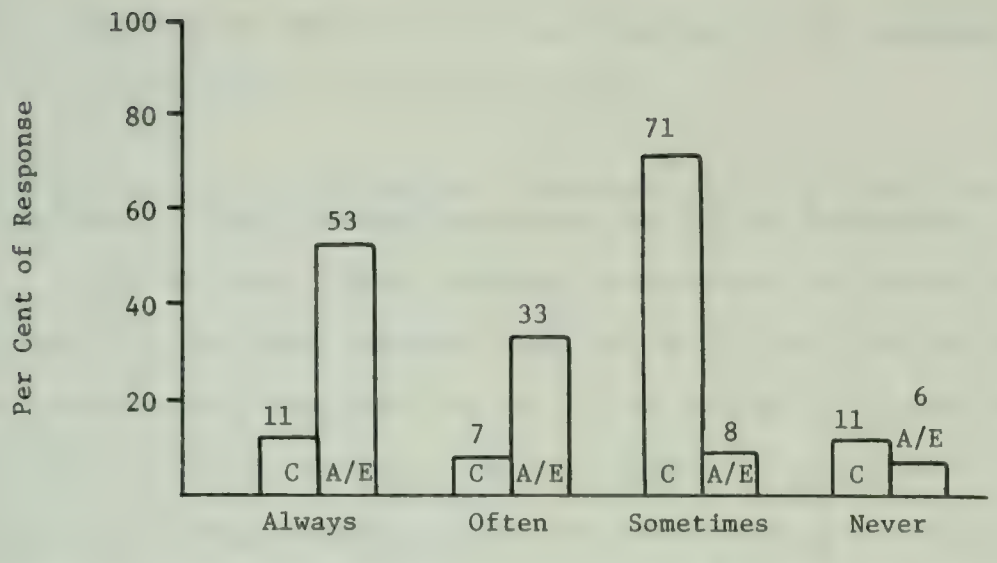


Figure 16 Architect/Engineer and Contractor Responses to Question 10e/d. Do you think that there would be a conflict of interest if the contractor inspected his own work?

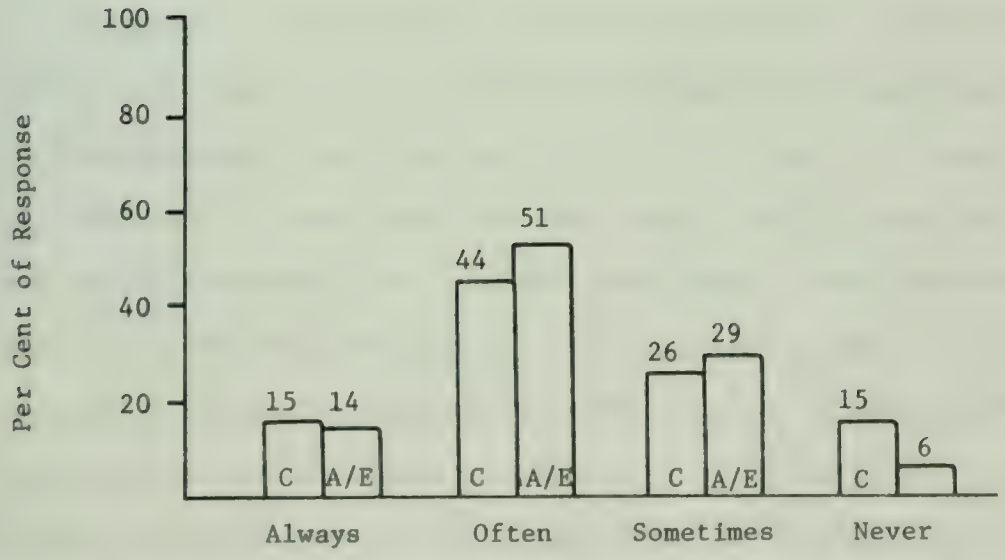


Figure 17 Architect/Engineer and Contractor Responses to Question 10f/c. Do you think that Contractor responsibility for inspection lends itself to a Contruction Management type of contract?

CM, they have the opportunity to work together for the common goal of giving the owner the most for his money.

Section 2a. Architect/Engineer Respondents Who Do Not Want the Contractor to Have the Sole Responsibility for the Inspection

There are twenty seven architect/engineers in this group (see Table IV). They have indicated that they do not want the contractor to have the sole responsibility for the inspection by replying "No" to Question 8 (see Table IV). The respondents in this group and the Architect/Engineers who replied "Yes" to Question 8 will be compared in Sections 2a and 2b. The data is presented in Appendices E, F, G, H, and I.

This group has indicated that 82% of the time inspection "always" ensures that the contractor provides the level of quality specified in the contract. They feel that inspection often helps find mistakes. Their emphasis on the required levels of inspection in hours per week is two and three times greater than the designers who have indicated that they would like the contractor to inspect (see Appendix G). When asked what the normal cost of inspection runs as a percentage of the contract award price, these designers indicated 1.8% which was lower than the 2.2% figure given by the other group of architect/engineers. The closeness of these figures, when compared to the results in Appendix G, would imply that this group provides the owner with a higher level of inspection for a comparable fee.

It can be concluded from Figure 18 that these designers feel that owners are willing to pay for inspection more often. In addition, the results shown in Figure 19 indicate that inspection is "never" too expensive to provide. In contrast, it can be seen from Figure 20 that owners often feel that inspection is important to the quality of the job. By comparing Figures 18 and 20, it can be concluded that this group feels that some owners are not always willing to pay for the inspection that they believe is important. These architect/engineers have implied that the owners that they normally work with are aware of the importance of inspection and are willing to fund that service. The higher levels of inspection that these designers believe is satisfactory is consistent with the responses shown in Figures 18, 19 and 20.

When asked if they would be willing to allow the contractor to inspect, twenty seven out of thirty seven architect/engineers replied "No". Of the twenty seven designers ten have had previous CQC experience. In order to determine why these design professionals responded "No" to the CQC question, an analysis was made of the data presented in Table XII and Figures 21 and 22. It can be concluded from Table XII that, this group of designers feels that most contractors who do work in the greater than one million dollar range provide a level of quality that is equal to or greater than that specified. The results presented in Figures 21 and 22 indicate that these designers believe that there would always be a conflict of interest if the contractor inspected his own work and that the contractor never could inspect the work better than the designer. This generally lower regard for contractors implies that this group

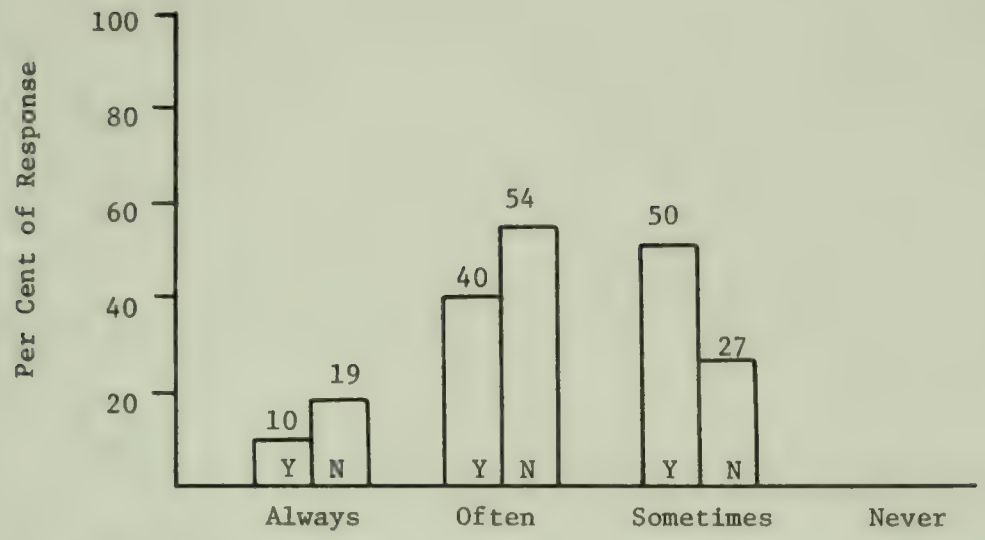


Figure 18 Architect/Engineer Responses to Question 4b(vi). Do you feel that Owners are willing to pay for "satisfactory" inspection?

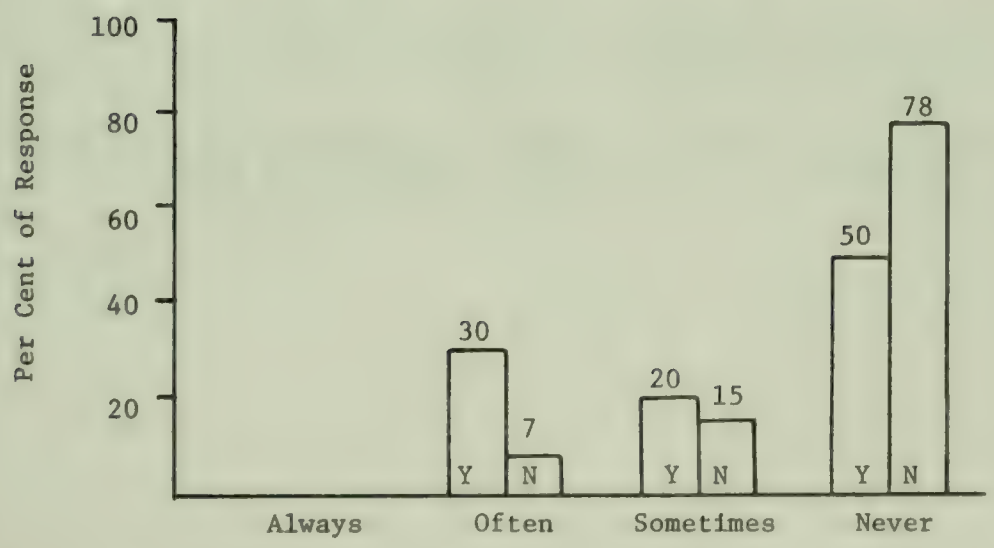


Figure 19 Architect/Engineer Responses to Question 4b(iv). Do you feel that the cost of "satisfactory" inspection is too high to provide?

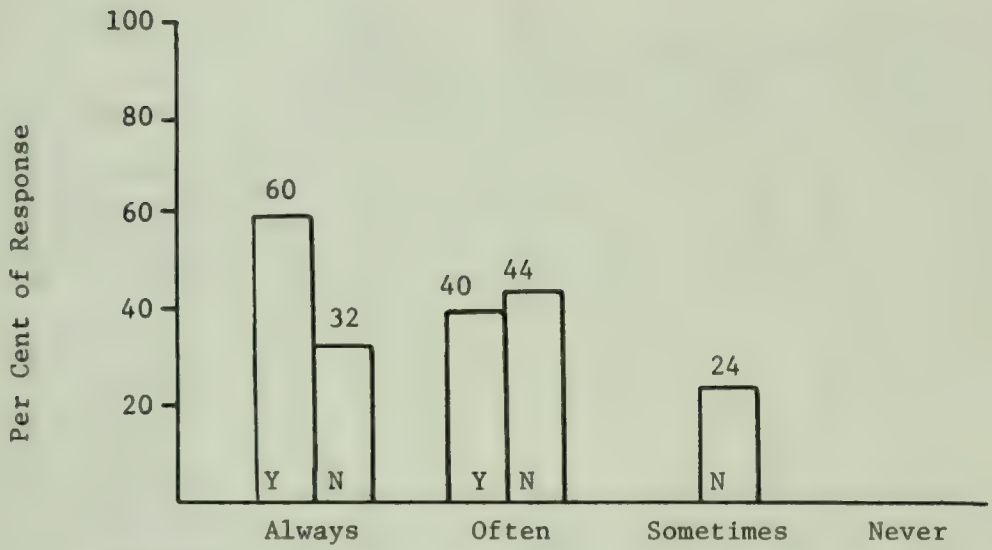


Figure 20 Architect/Engineer Responses to Question 10b. Do you think that Owners feel that inspection is important to the quality of the job?

Table XII

Architect/Engineer Responses to Question 7

To your knowledge, do contractors in the following categories have a tendency to provide:[1]

	Up to $100,000 per award		Up to $500,000 per award		Up to $1Million per award		Up to $3Million per award		Unlimited per award	
	Y[2]	N	Y	N	Y	N	Y	N	Y	N
a) Just enough Quality Control to get by	71.4	90	62.5	76.2	37.5	52.4	20	39.1	20	42.1
b) Level of Quality Control that is required by the Plans/ Specifications as interpreted by the Designer	28.6	10	37.5	23.8	62.5	47.6	60	43.5	60	36.8
c) Level of Quality Control that is higher than (b) to enhance company reputation	0	0	0	0	0	0	20	17.4	20	21.1
Total No. Responses	7	20	8	21	8	21	10	23	10	19

Note:
1. Values for a,b,c are percentages of the Total No. of Responses.
2. See Table IV for explanation of "Y" and "N".

Figure 21 Architect/Engineer Responses to Question 10e. Do you think that there would be a conflict of interest if the contractor inspected his own work?

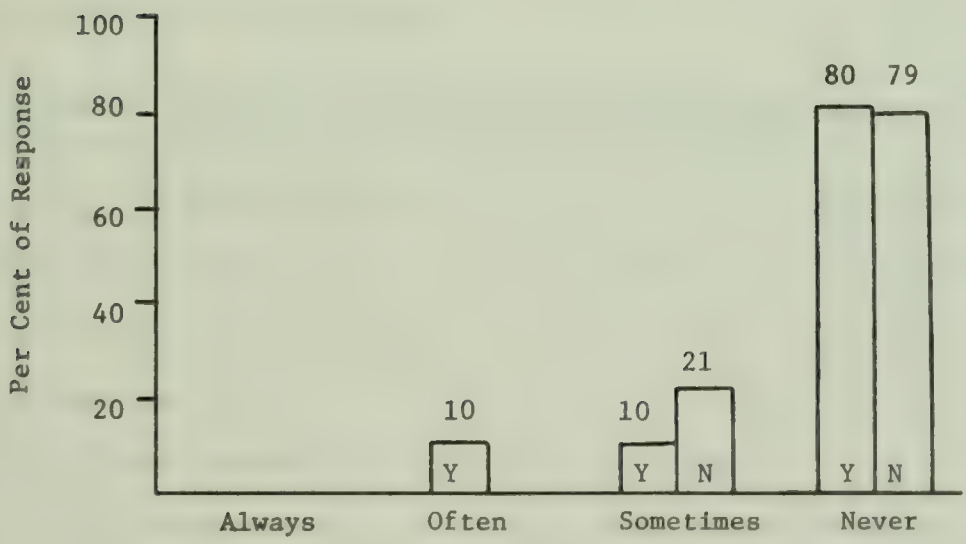


Figure 22 Architect/Engineer Responses to Question 10d. Do you think that the contractor can have the sole responsibility for the inspection and properly inspect a job better than the designer?

of designers feel that they do not provide a high enough level of quality to warrant placing the responsibility for the inspection with them. This is an important point because a certain degree of mutual trust must exist for CQC to work effectively.

It can be concluded from the data presented in this section that the designers who replied "No" to the CQC question are satisfied with their role as advisor and representative of the owner. This traditional role, according to some of the comments received and reprinted in Appendix I, signifies an important system of checks and balances. They are of the opinion that they often provide satisfactory inspection and that the contractor never could perform it any better. Their generally low regard for contractors implies that their opinion of inspection which must be provided by the designer is a necessary function to ensure that the owner receives the most for his money.

Section 2b. Architect/Engineer Respondents Who Want the Contractor to Have the Sole Responsibility for the Inspection

The ten architect/engineers in this group have indicated that they are willing to let the contractor have the sole responsibility for the inspection by replying "Yes" to Question 8 (see Table IV). With only ten replies conclusions cannot be as well founded, although some interesting trends have developed.

These designers place less emphasis on the ability of inspection to ensure that the specified quality is provided with 62% in the always category. They feel that it is equally as useful in finding mistakes made by the contractor. The satisfactory levels of inspection for this group are significantly lower than the other

group of designers which can be seen in Appendix G. The results shown in Figures 18, 19 and 20 imply that these designers do not feel that owners are as willing to pay for the inspection that, in contrast, they feel is so important to the quality of the job. In addition, inspection is "sometimes" too expensive to provide. These trends are indicative of an inadequate fee problem that may have influenced their answers.

It can be concluded from the data presentation in Table XII that these designers believe in general that contractors who perform work on contracts greater than $500,000 provide a level of quality that is equal to or greater than that specified. They are less inclined to believe that there is a conflict of interest with CQC (Always: 25%) (see Figure 21), but they have indicated (see Figure 22) that the contractor can "never" inspect the work better than the designer. The data presented in Figure 23 implies that satisfactory inspection "often" reduces the cost of construction for the contractor. At the same time they feel that the contractor should always (100%) be responsible for the quality of his job. It can be concluded that these more favorable responses are part of the reason for the "Yes" replies for CQC.

The designers in this group were willing to allow the contractor to have the sole responsibility for the inspection with an extended warranty of three years. As part of the responsibility in this CQC program they were in favor of letting the contractor perform the quality control inspections (Yes: 60%) and the testing (Yes: 90%). Sixty percent felt that the contractor should have a quality control organization, while ninety percent indicated that

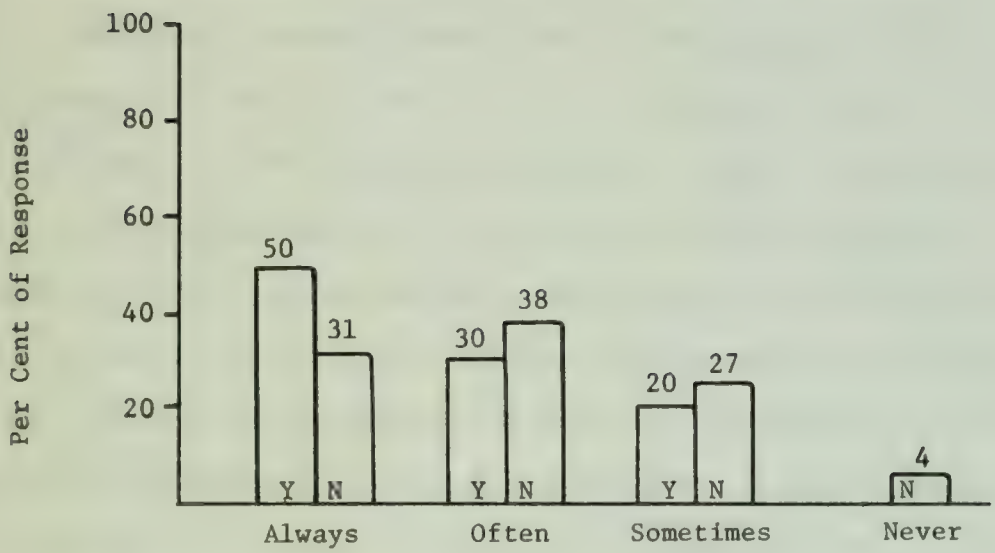


Figure 23 Architect/Engineer Responses to Question 10a. Do you think that satisfactory inspection reduces the cost of construction for the contractor?

he should submit periodic inspection reports. All of the designers in this group wanted to interpret the plans and specifications. They were divided (50/50) on the subject of contractor approval of shop drawings. Ninety percent were against the contractors having final acceptance authority. It can be seen that the only aspects of this CQC program that were well received were submission of reports and designer interpretation of the contract documents.

The annual contract award volumes of the respondents presented in Table XIII indicate that there is a significant amount of "No" responses in the "$10 million and greater" category. Although the other questions asked do not show any trends according to the annual contract award volumes, it is significant to note that about fifty percent of the firms in the smaller ranges are in favor of CQC. Three of the respondents in this group commented on this program (see Appendix I). One had been forced to eliminate designer inspection as a method of "pseudo economy for the owner". Another indicated that the contractor should be required to have well qualified and trained personnel to run his jobs. He concluded his comment when he stated that "a better system is a must to get better production with fewer qualified men".

It is believed that several reasons have motivated these designers to want the contractor to inspect his own work. They have indicated that inspection is not a conclusive method of ensuring quality and finding mistakes. The levels of satisfactory inspection shown in Appendix G substantiate this theory. Inadequate fees are also a problem that may have motivated some of the designers to respond "Yes" to the CQC question. Smaller firms may have difficulty

Table XIII

Architect/Engineer Annual Contract Award Volume Breakdown According to Question 8 Responses

Annual Contract Award Volume	Architect/Engineer Responding "Yes" to Question 8 (Yes to CQC)	Architect/Engineer Responding "No" to Question 8 (No to CQC)
$1-4.99 Million	4	7
$5-9.99 Million	3	6
$10 Million and Greater	3	14

funding this function out of their own budgets. The higher regard for contractors that this group has shown is an important step toward making CQC work. In contrast, they were not really enthusiastic about the responsibilities and authority that the CQC program outlined in Question 9 discussed. These factors indicate that the ten respondents in this group are not motivated by a basic reason like the architect/engineers who replied "No" to CQC. Under these conditions it would be unwarranted to draw any further conclusions that would categorize them in support of a specific conclusion as to why they want the contractor to inspect his own work.

Section 3a. Contractors Who Do Not Want the Sole Responsibility for the Inspection

The fifteen contractors in this group indicated that they did not want the sole responsibility for the inspection by replying "No" to Question 8 (see Table IV). It can be concluded from Figures 24 and 25 that these contractors have a high opinion of the designer's regard for inspection. Only "sometimes" is inspection used to get work that is not clearly shown in the contract documents. They have indicated that designers "often" furnish satisfactory inspection (see Appendix H). This is a much more favorable response than that received from the contractors who want to inspect their own work. It can be concluded from these results that the contractors who have responded "No" to CQC feel that the designers that they have been associated with have done a good job with the inspection of their work.

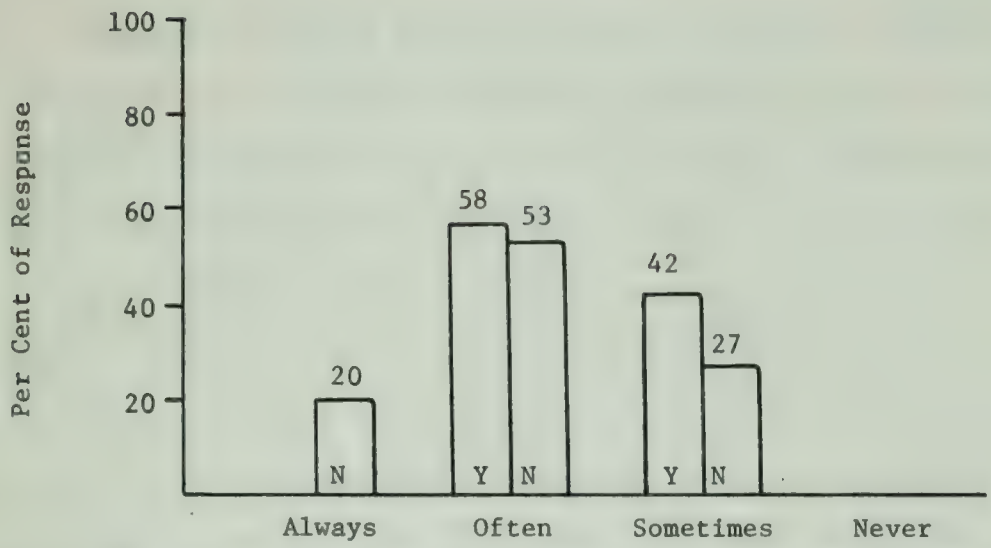


Figure 24 Contractor Responses to Question 3a. Do you feel that the Designers that you have worked with have had a good regard for inspection?

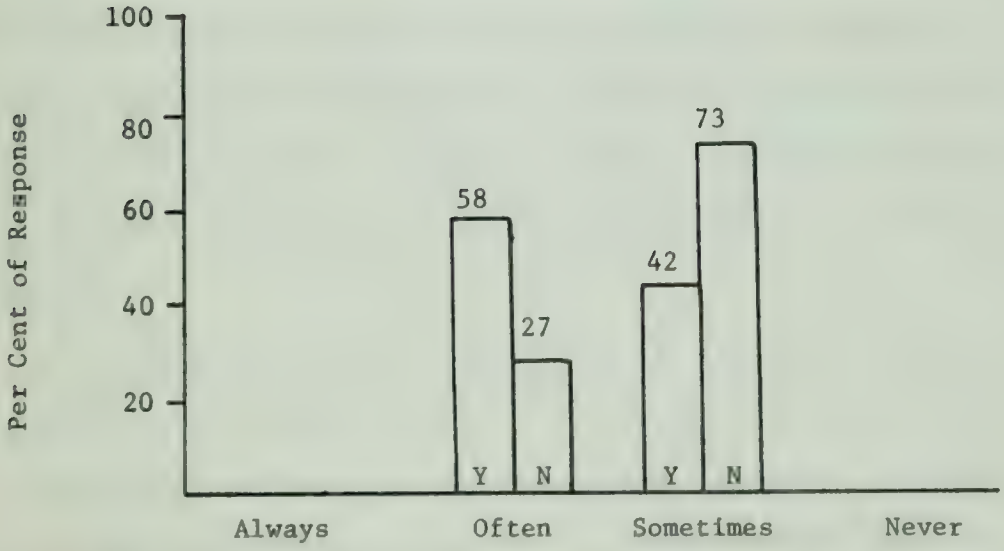


Figure 25 Contractor Responses to Question 3b. Do you feel that the Designers that you have worked with have used inspection to get work that is not clearly shown in the Plans and Specifications?

They have indicated that they always (72%) like to have inspection on their jobs (see Appendix H), although it can be seen in Figures 26 and 27 that inspection is not always a conclusive method of ensuring quality and finding mistakes. It can be concluded from Appendix G that both groups of contractors are very close in their responses to the architect/engineers who do not want the contractor to have the sole responsibility for the inspection. These responses imply that, although the contractors in this group do not feel that inspection is the sole remedy for finding mistakes and ensuring quality, it is an important service that they like to have on their work in unusually large amounts.

These respondents are convinced that the contractor should be responsible for the quality of his work (see Figure 28). Their opinion of the level of quality that the typical contractor provides is higher than that of the other group (see Appendix H). It can be concluded that this group of contractors has a high regard for inspection, quality workmanship, and the construction industry in general. These feelings are important facets of a good CQC program.

The data presented in Table XIV and XV indicates that inspection by the designer and/or his representatives is the preferred method of inspection by both groups. Although the figures are small, the contractors who do not want to inspect their own work have indicated a desire to participate more in the inspection process. It can be concluded from the data in these tables that the contractors in this group who stated that they wanted more responsibility for inspection were not satisfied with the CQC program

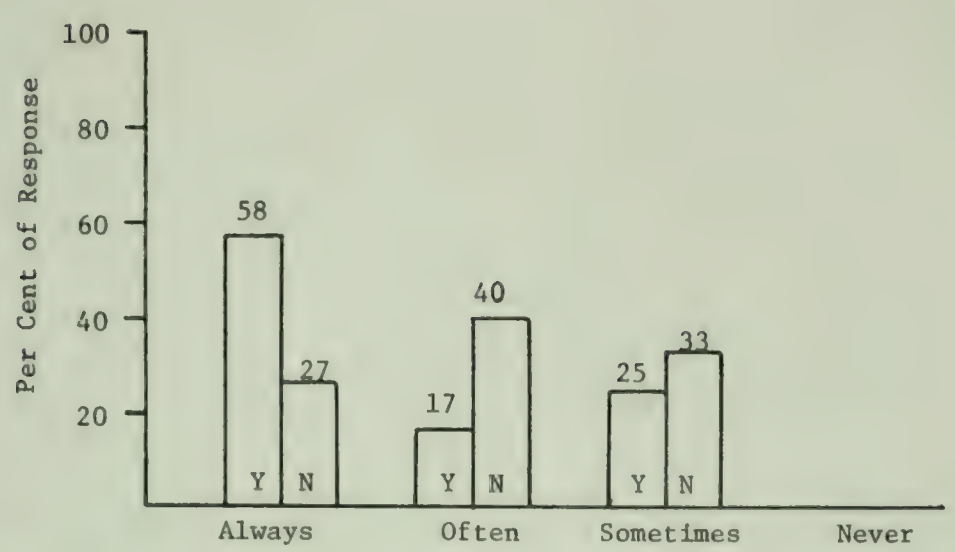


Figure 26 Contractor Responses to Question 4b. Do you feel that inspection is a good tool to ensure that the contractor provides the level of quality specified in the contract?

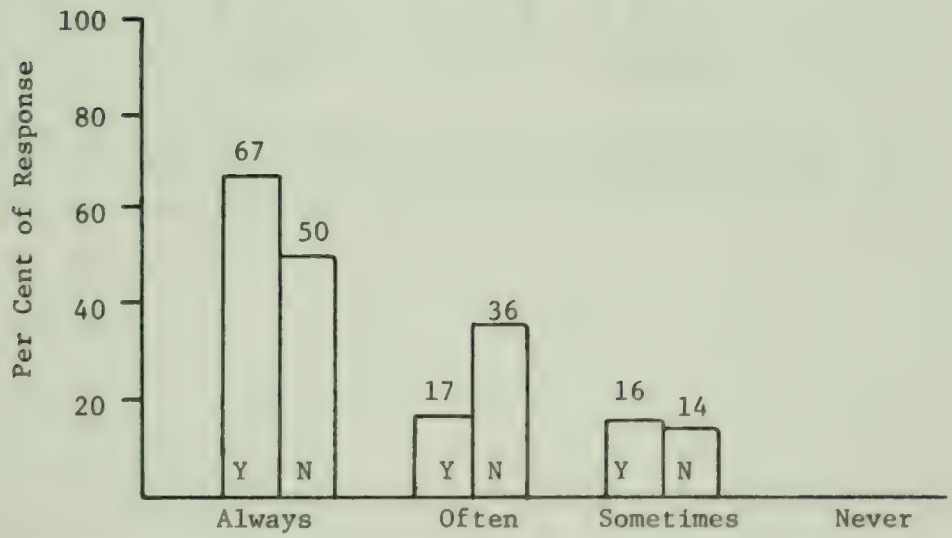


Figure 27 Contractor Responses to Question 4c. Do you feel that inspection is a good tool to help even the best of contractors find mistakes?

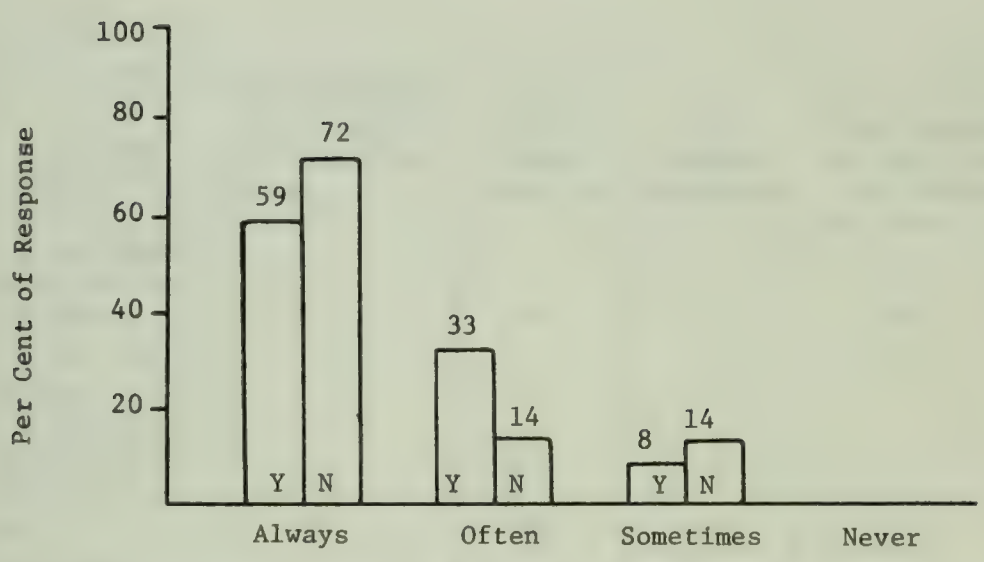


Figure 28 Contractor Responses to Question 10f. Do you think that the Contractor should be responsible for the quality of his job?

Table XIV

Contractor Responses to Question 2.
Responsibility for Inspection and Quality Control

Responsibility Categories	Interpretation of the Plans and Specifications	Quality Control Inspection	Job Progress Inspection	Final Acceptance of each stage of the work
Designer and/or his Representative	71	49	59	65
Shared: dual responsibility for the Designer and the Contractor	5	12	12	6
Contractor	3	16	7	1
Total No. Responses	79	77	78	72

Table XV

Contractor Responses to Question 2. Contractor Responsibility for Inspection and Quality Control According to Question 8 Replies

Inspection Categories	Full Responsibility to the Contractor		Shared Responsibility: Contractor and Designer	
	Y[1]	N	Y	N
a) Interpretation of the Plans and Specifications	3	-	4	1
b) Quality Control Inspection	7	5	11	5
c) Job Progress Inspection	6	1	8	4
d) Final Acceptance of each stage of the work	1	-	4	2
Total No. Responses	17	6	27	12

Note:

1. See Table IV for explanation of "Y" and "N".

outlined in the questionnaire. Table XVI illustrates the annual award volume of these contractors according to their responses to the CQC question. There does not appear to be a dominant annual volume range that either likes or dislikes CQC. Nine of the contractors in this group have had previous CQC experience.

It can be concluded from Figure 30 that this group feels that there would be more of a conflict of interest if the contractor inspected his own work. Figure 29 illustrates the feeling that the contractor can only "sometimes" inspect the work better than the designer.

The contractors in this group are definitely against CQC. They have indicated that they feel that the designer "often" provides satisfactory inspection. It can be concluded from Figures 26, 27, and Appendices G and H (Question 4v) that these contractors like to have an outside inspection force as a part of the systems of checks and balances in construction. The desire of a few contractors to take a more active role in quality control and inspection demonstrates a low desire to create a new system for handling these functions. A contractor inspects his work periodically to ensure that it is in compliance with the contract documents. The idea of quality when questioned by the subcontractors often places the "General" in a conflict of interest situation. Designer inspection alleviates this problem.

Table XVI

Contractor Annual Contract Award Volume Breakdown
According to Question 8 Responses

Annual Contract Award Volumes	Contractors Responding "Yes" to Question 8 (Yes to CQC)	Contractors Responding "No" to Question 8 (No to CQC)
$100,000 to $499,999	1	-
$500,000 to $999,999	-	1
$1 Million to $4.99 Million	5	3
$5 Million to $9.99 Million	2	3
$10 Million and Greater	4	8
Total No. Responses	12	15

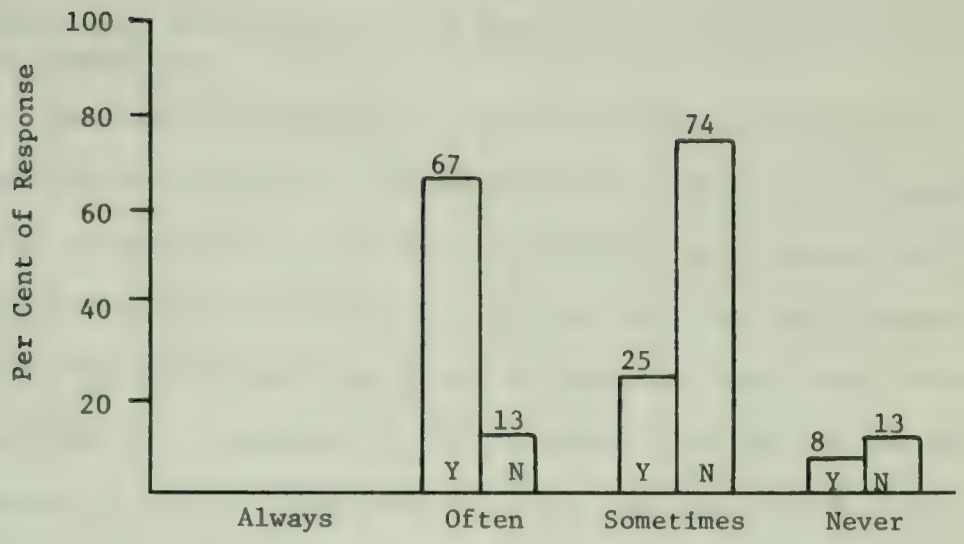


Figure 29 Contractor Responses to Question 10c. Do you think that the contractor can have the sole responsibility for the inspection and properly inspect a job better than the designer?

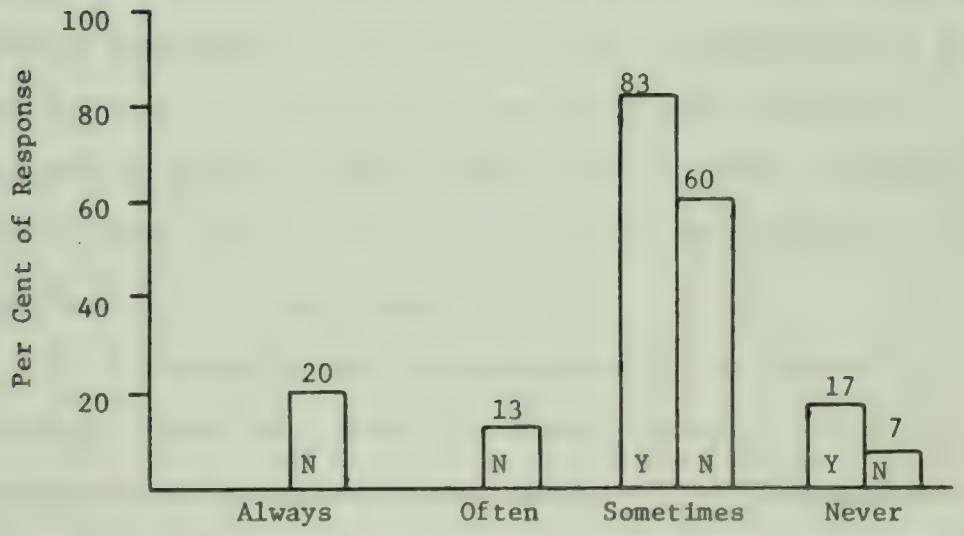


Figure 30 Contractor Responses to Question 10d. Do you think that there would be a conflict of interest if the contractor inspected his own work?

Section 3b. Contractors Who Do Want the Sole Responsibility for the Inspection

The twelve contractors in this group indicated that they wanted to have the sole responsibility for inspection by responding "Yes" to Question 8. When these respondents were compared with the contractors who stated that they did not want the sole responsibility for the inspection, it was evident that this group is dissatisfied with inspection by the designer. This can be seen in Figures 24 and 25. They have indicated (see Appendix H) that designers "sometimes" provide satisfactory inspection. This dissatisfaction could be the primary motivation for their desire to have the sole responsibility for the inspection.

Even though their regard for designer inspection is lower, their feelings about inspection ensuring the quality of the work and finding mistakes is higher than the responses made by the other group of contractors. In contrast, it can be seen in Figure 31 that the cost of satisfactory inspection is more "often" too expensive to provide. Fifty eight percent of these respondents believed that the contractor should "always" be responsible for the quality of his job (see Figure 28).

It is interesting that these contractors, in response to Question 1 (Table XV), showed the highest desire of all of the contractors and designers to participate in the inspection and quality control responsibilities. Admittedly the figures are small in comparison with the total, but they were given before any mention of CQC was made. All of these contractors have had previous experience with CQC. For a one and a half year extended warranty period,

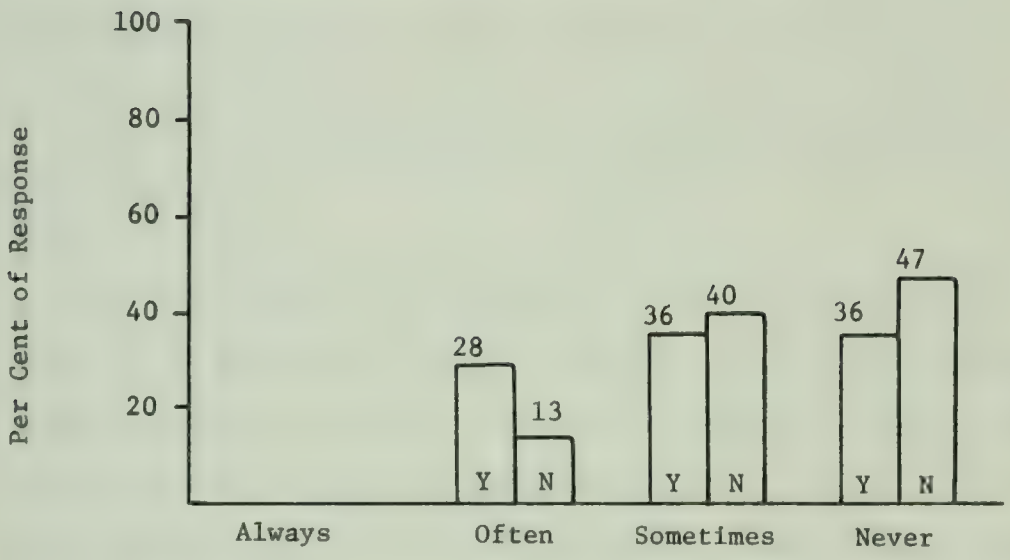
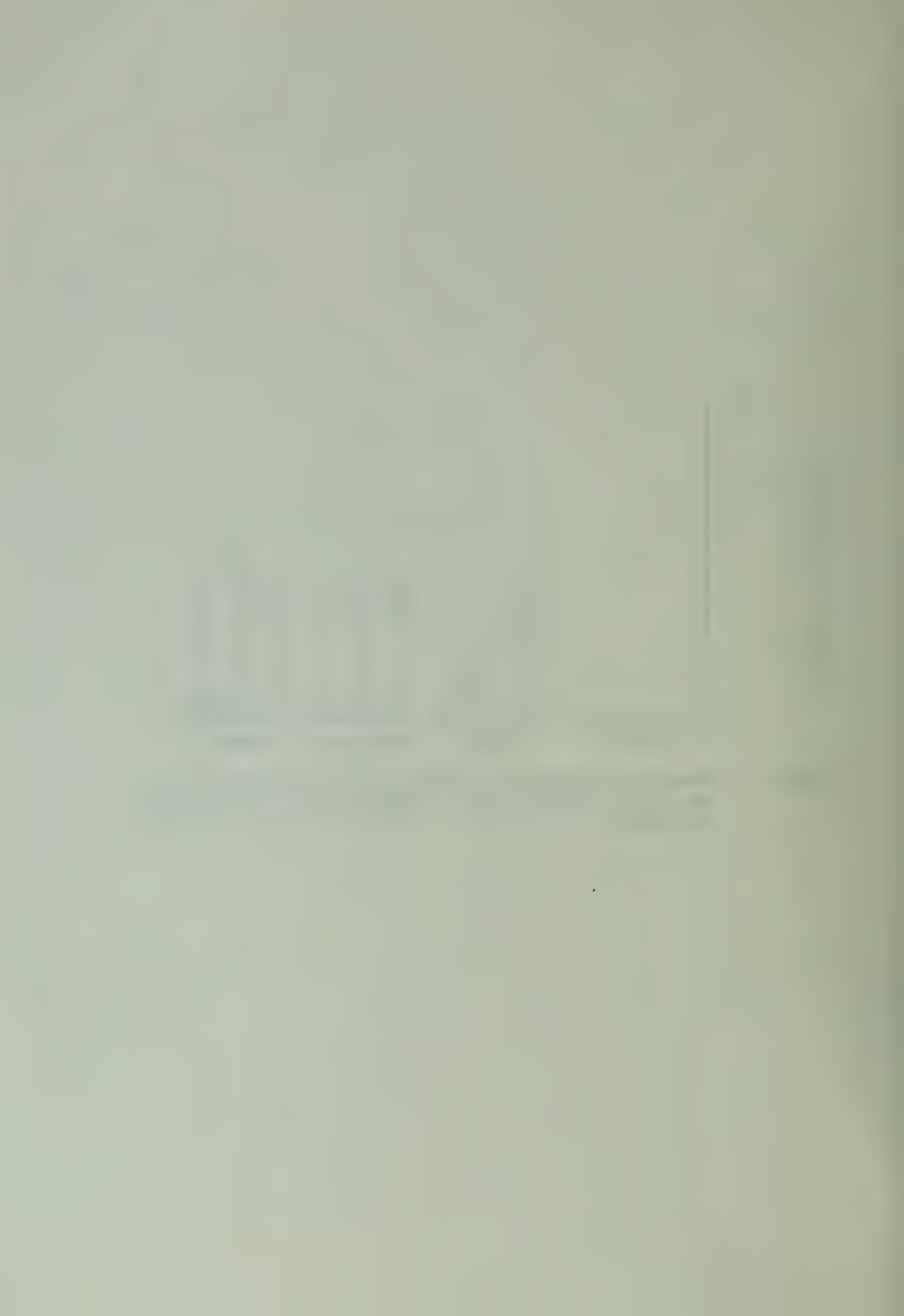


Figure 31 Contractor Responses to Question 4e. Do you feel that the cost of "satisfactory" inspection is too expensive to provide?



they were willing to approve the shop drawings (75%), perform the quality control inspections (92%), provide the testing requirements (92%), and submit periodic inspection reports (92%). Sixty four percent of the respondents wanted the designer to interpret the plans and specifications. They were closely split on the subject of performing the final acceptance inspection and of being required to have a quality control organization (see Appendix H). They indicated that "sometimes" there would be a conflict of interest if the contractor inspected his own work and that they "often" could inspect the work better than the designer. This is shown in Figures 30 and 31.

These contractors, who responded "Yes" to the CQC question, appear to be motivated by several factors. There is a significant dissatisfaction with designer inspection. They see inspection and quality control as important functions that they "always" like to have on their jobs. They are not inhibited by the thought of performing their own inspections. In contrast, the split over having a quality control organization, particularly in light of some of the contractors in this group having lower responses to the two questions concerning the time requirement of inspection in hours per week and the amount of responsibility that the contractor should have for the quality of his work (Figure 28), indicates that a few of them are not as serious about CQC as the others. Some of the respondents may feel that a quality control organization is not important and that it represents unnecessary overhead costs. Someone must be qualified to approve shop drawings if the contractor is to retain that responsibility. For small organizations an

additional man for quality control might be an unjustified financial strain. The mix of factors discussed in this section imply that CQC could be used on a limited basis on larger contracts. It is impossible to say which respondent should or should not be included in this consideration. For some the justification is because inspection has been handled poorly on their jobs. For this reason, they want to have more responsibility for the inspection in order to ensure that it is performed satisfactorily.

Section 4. General Analysis of Navy Related Respondents

The three groups discussed in this section are Navy (also called ROICC) personnel, CQC representatives, and CQC contractors. The contractors have had previous experience with the Navy's CQC program, and will be called CQC contractors. The distribution of these three groups is presented in Table V. A complete presentation of the data can be found in Appendices J thru N.

These respondents represent the experience received from over 673 CQC contracts at Navy Resident Officer in Charge of Construction (ROICC) Offices all over the United States. The Navy personnel, the CQC contractors, and the CQC representatives have expressed varying opinions concerning the Contractor Quality Control program that was adopted by the Navy in 1970. These opinions have been reflected in the data. They are significant factors that have affected the overall success of the program.

The regard of the Navy personnel toward CQC and inspection was the topic of several questions. It can be concluded from Figure 32 that the regard that ROICC personnel have had for

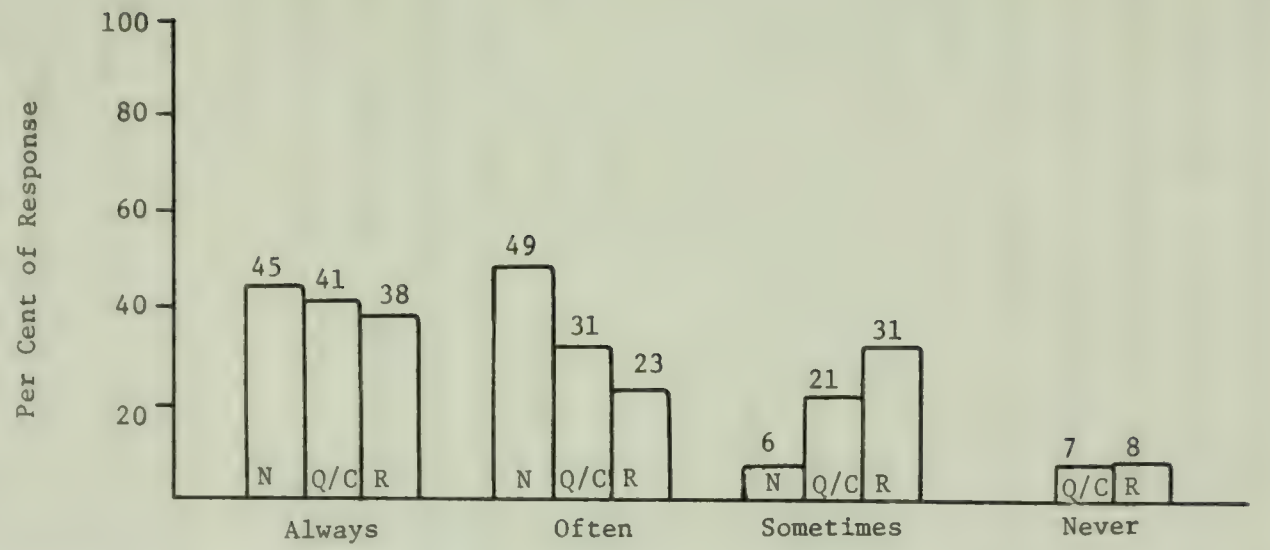


Figure 32 Responses from Navy Related Personnel to Question 3a. Do you feel that the Navy ROICC office personnel that you have worked with on CQC jobs have had a good regard for inspection?

inspection is often good. The opinions of the CQC contractors and the CQC representatives are not concentrated in any one category in both Figures 32 and 33 which implies that there is a diverse range of opinions as to the regard that Navy personnel have had for both inspection and CQC. The data represented in Figure 34 indicates that ROICC personnel rarely use inspection to get work that is not clearly shown in the contract documents. The CQC representatives have registered a significant response in the upper two ranges on this question. In that they work the most closely with the Navy construction representatives, this could be an indication of a small amount of dissatisfaction concerning interpretation of the plans and specifications. The responses illustrated in Figure 35 show that there is only a small difference of opinion about how well the Navy personnel have understood CQC. The general opinion is that it is "sometimes" understood.

It can be concluded from these figures that the CQC representatives have the least favorable range of opinions of ROICC personnel. These mixed responses indicate that there is a lack of uniformity in the administration of the inspection and CQC functions by ROICC offices.

It can be concluded from studying Table XVII that Navy personnel have the lowest regard for the level of quality that contractors typically provide of the three groups discussed in this section. Only contractors in the unlimited range have a significant majority of responses in the "equal to or greater than" categories, according to the Navy personnel. The contractors have indicated that their peers provide work that is primarily "equal to or greater than the

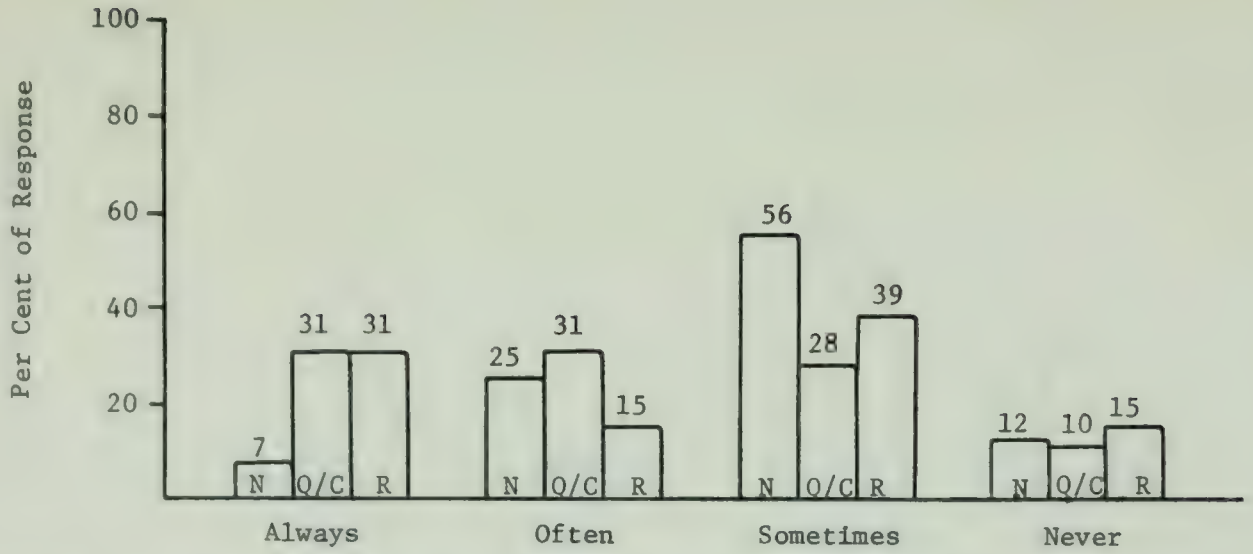


Figure 33 Responses from Navy Related Personnel to Question 3e/f. Do you feel that the Navy ROICC office personnel that you have worked with on CQC jobs have had a good regard for the CQC program?

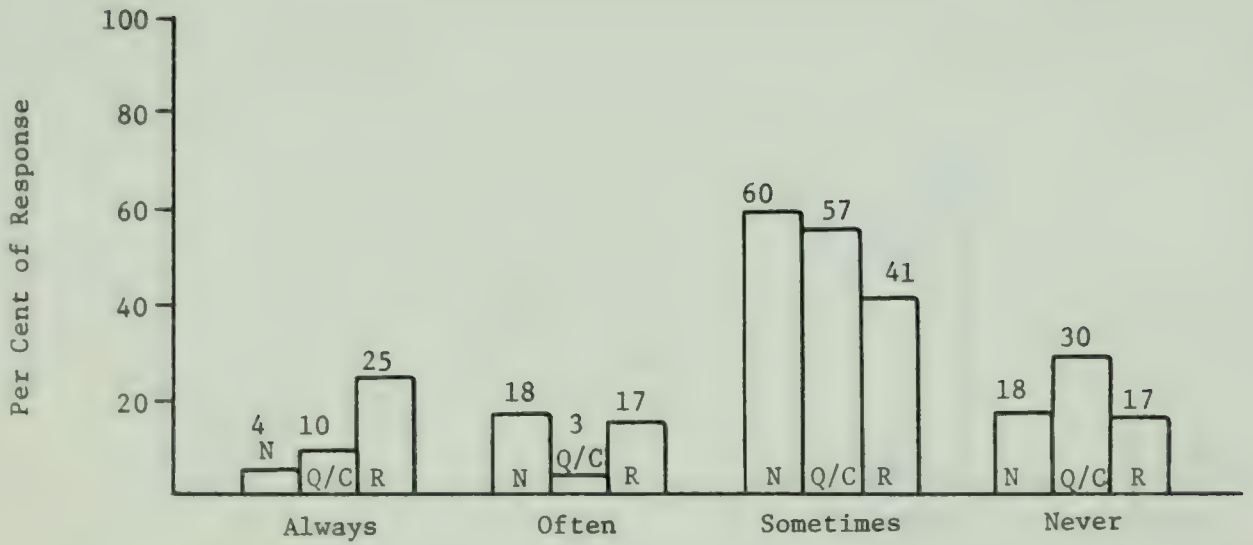


Figure 34 Responses from Navy Related Personnel to Question 3b. Do you feel that the Navy ROICC office personnel that you have worked with on CQC jobs have used inspection to get work that is not clearly shown in the Plans and Specifications?

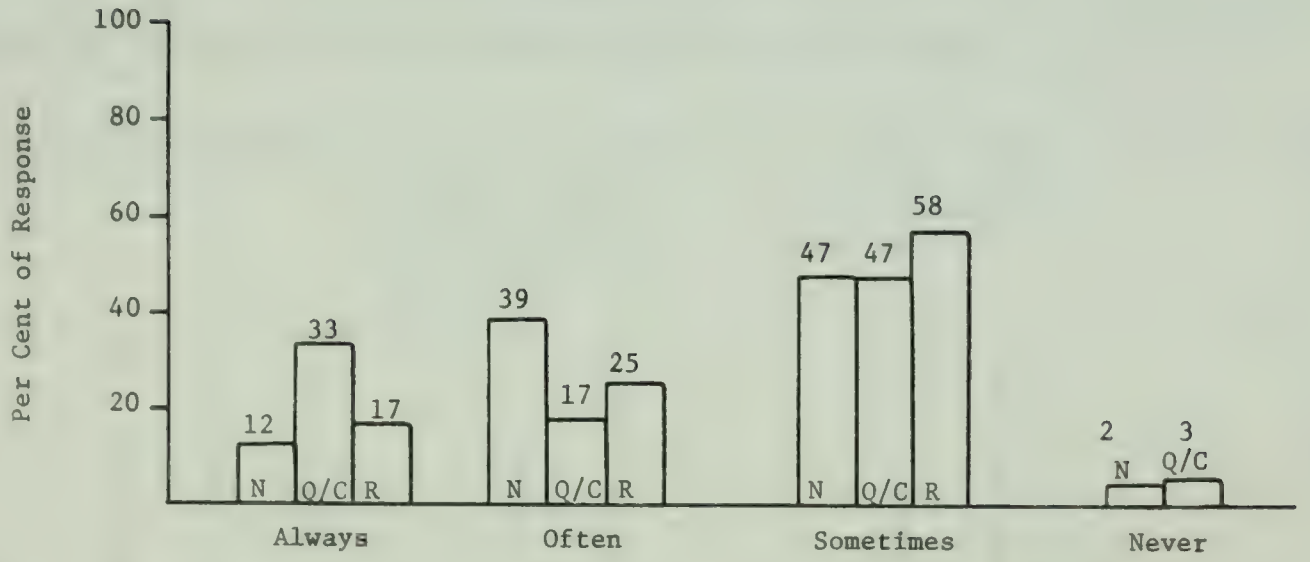


Figure 35 Responses from Navy Related Personnel to Question 8a. In considering past CQC contracts, do you think that Navy personnel have understood CQC?

Table XVII

Navy Related Responses to Question 5

To your knowledge, do contractors in the following categories have a tendency to provide:[1]

	a) Just enough Quality Control to get by			b) Level of Quality Control that is required by Plans & Specifications as interpreted by the ROICC			c) Level of Quality that is higher than (b) to enhance company reputation			Total No. Responses		
	Navy	CQC Contractor	CQC Representative	Navy	CQC Contractor	CQC Representative	Navy	CQC Contractor	CQC Representative	Navy	CQC Contractor	CQC Representative
Up to $100,000 per award	93	92	67	7	8	16	-	-	16	30	13	6
Up to $500,000 per award	78	65	50	22	30	33	-	5	17	36	20	6

Table XVII (continued)

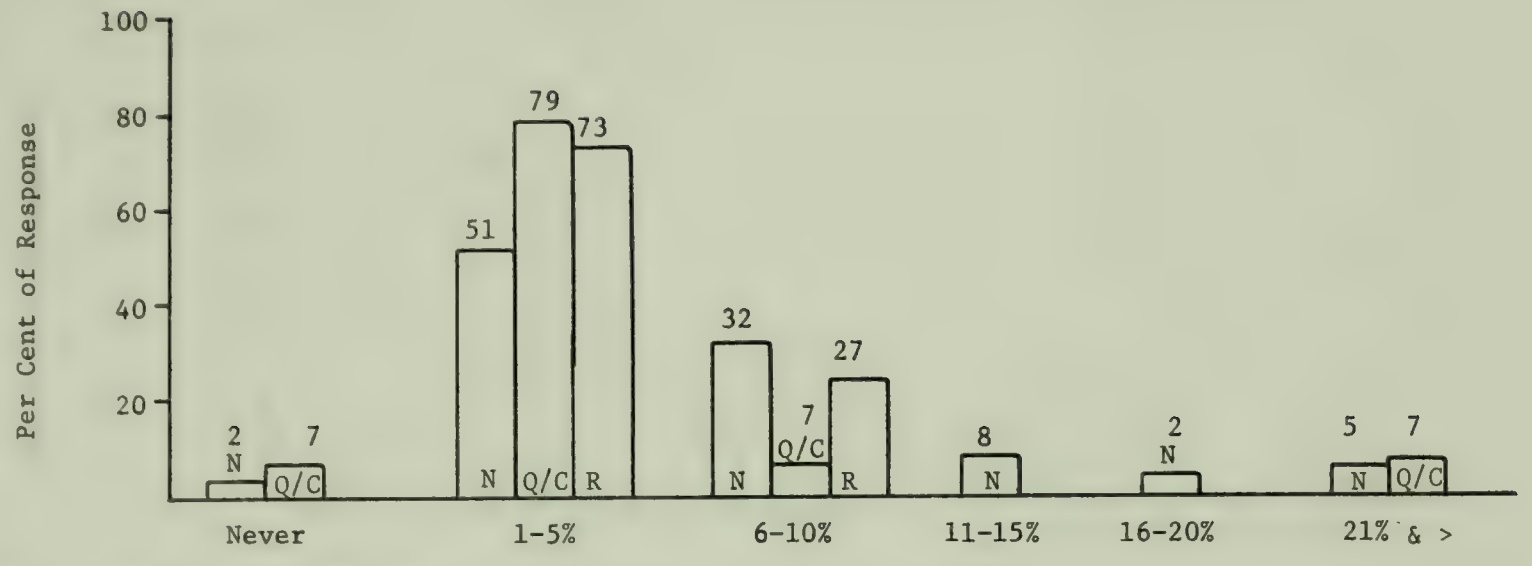
	Navy	CQC Contractor	CQC Representative	Navy	CQC Contractor	CQC Representative	Navy	CQC Contractor	CQC Representative	Navy	CQC Contractor	CQC Representative
Up to $1Million per award	63	47	25	33	47	25	4	6	50	40	17	8
Up to $3Million per award	47	12	27	42	50	9	11	38	64	53	26	11
Unlimited per award	38	8	17	38	56	-	24	32	83	40	12	6

Note: 1. Values for a, b, c are percentages of the Total No. of Responses.

quality specified" in the upper two ranges. In contrast, the CQC representatives believed the majority of the contractors in the upper three ranges provide quality that is greater than that specified. Ironically, the CQC contractors have stated that the Navy requires them to redo less work than they redo on their own initiative (see Figures 36 and 37). The Navy personnel on the other hand, feel that they require the contractor to redo more work. It can be concluded that, in some instances, these differing opinions could have a negative effect on the success of a CQC program.

The Navy personnel and the contractors held similar opinions of inspection. In Figures 38 thru 40 it can be seen that both groups like to have inspection on their jobs. It helps them find mistakes and contributes to the final quality achieved. The Navy respondents may place more emphasis on inspection as a tool to ensure quality rather than as a method of finding mistakes. These favorable responses indicate that these two groups see inspection as an important service. In contrast, the CQC representatives are divided consistently on these questions. This is an implication that their attitude towards the effectiveness of inspection is much lower than the other two groups. They might have interpreted service to mean that the inspection would be provided by someone other than the CQC representative. These lower responses could mean that the CQC representative is having a difficult time properly inspecting the work because he is on the contractor's payroll.

The respondents were asked to define satisfactory inspection. Those responses are presented in Table XVIII and in Figure 41. Small contracts less than $500,000, require a much higher relative


Per Cent of Response
100
80
60
40
20
2
N
7
Q/C
51
N
79
Q/C
73
R
32
N
7
Q/C
27
R
8
N
2
N
5
N
7
Q/C
Never
1-5%
6-10%
11-15%
16-20%
21% & >
Figure 36 Responses from Navy Related Personnel to Question 6/7. How often do you (the Navy) require the contractor to redo work because it is not satisfactory?

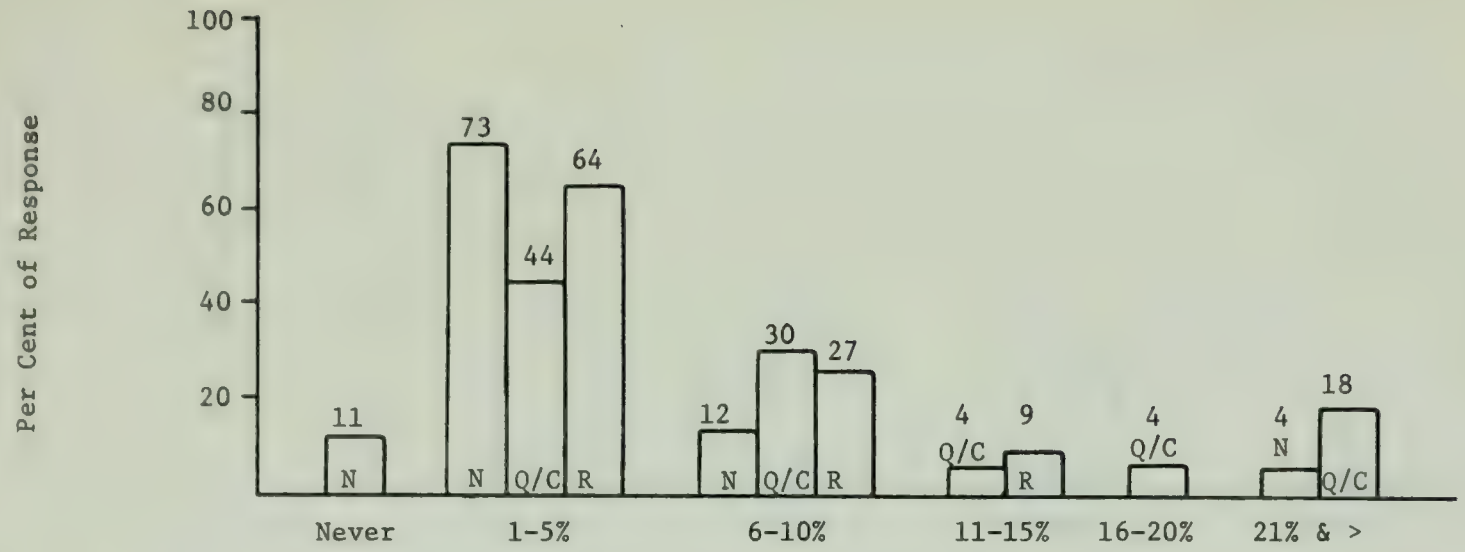


Figure 37 Responses from Navy Related Personnel to Question 7/6. How often does the contractor on his own initiative require his forces to redo work that is not satisfactory?

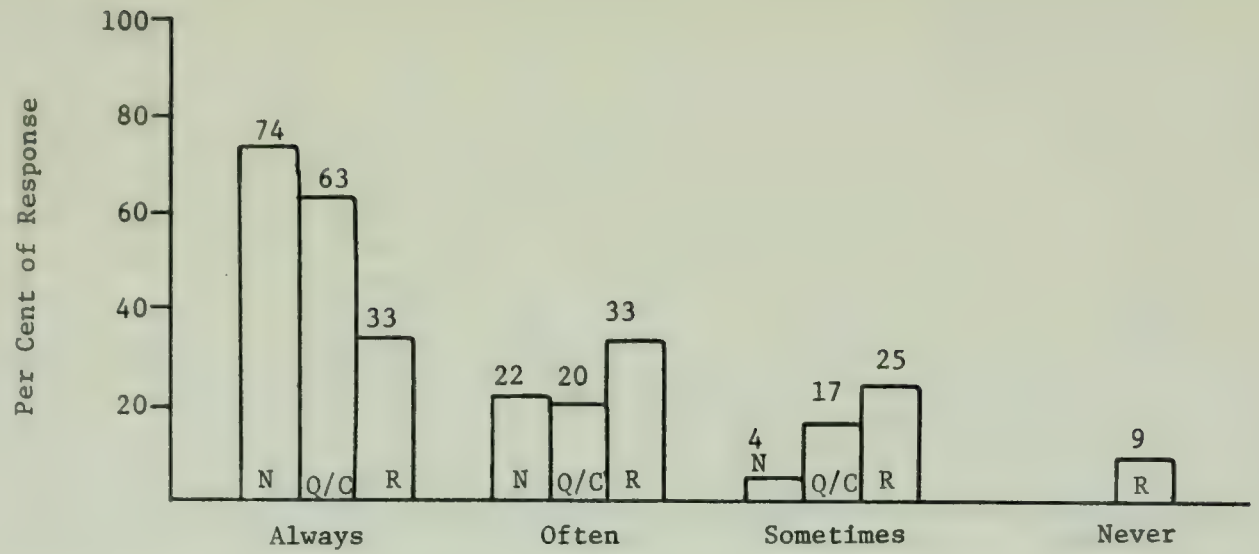


Figure 38 Responses from Navy Related Personnel to Question 4a. Do you feel that inspection is a good tool to ensure that the contractor provides the level of quality specified in the contract?

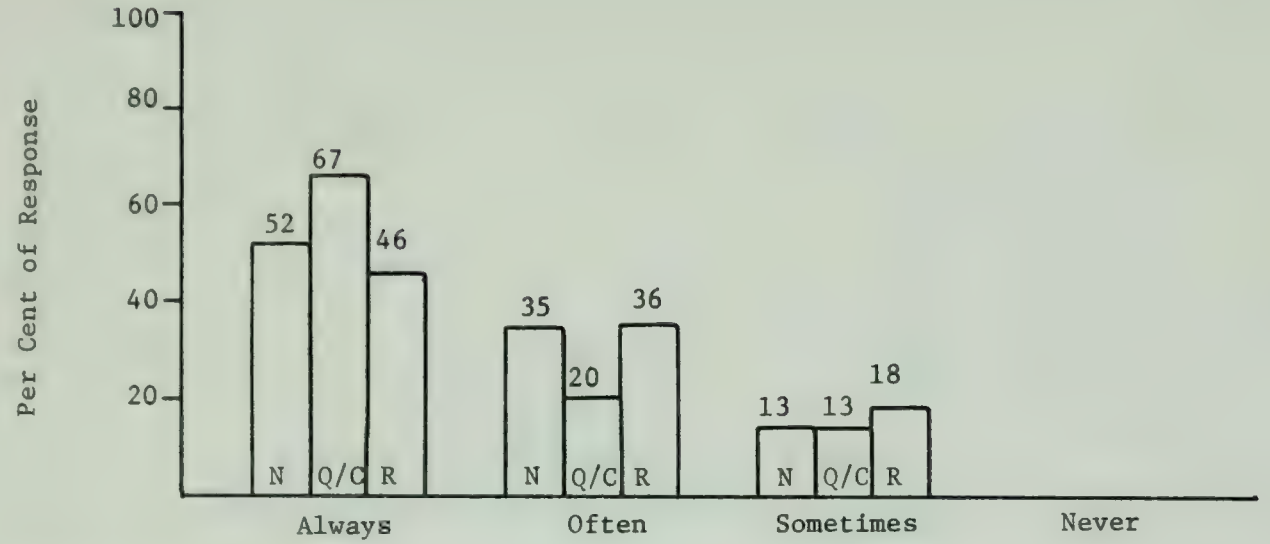


Figure 39 Responses from Navy Related Personnel to Question 4b. Do you feel that inspection is a good tool to help even the best of contractors find mistakes?

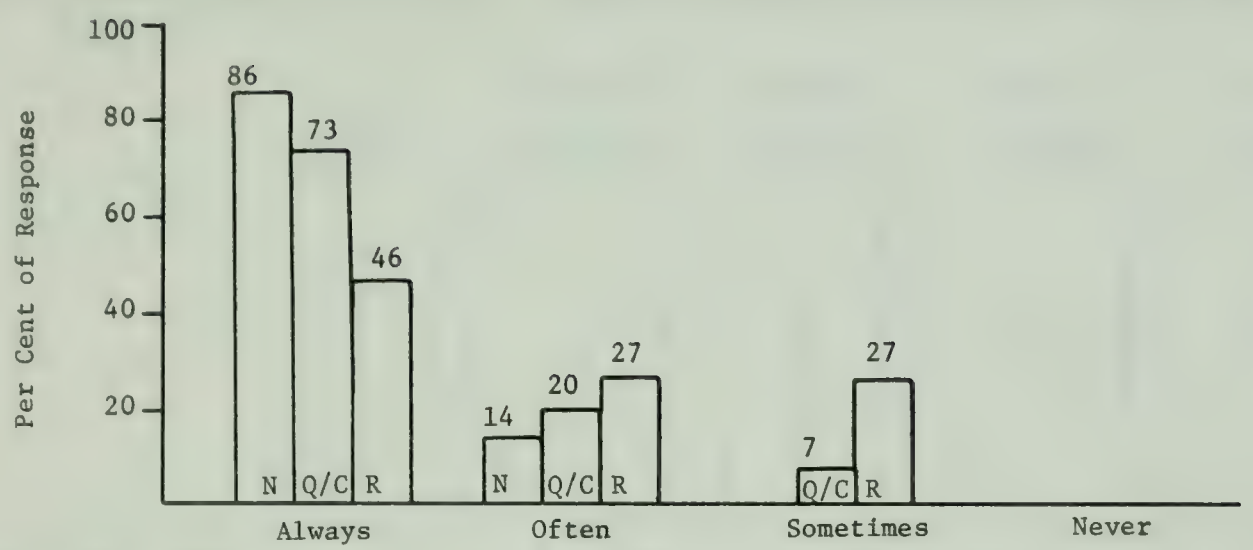


Figure 40 Responses from Navy Related Personnel to Question 4c. Do you feel that inspection is a service that you like to have on your job?

Table XVIII

Navy Related Responses to Question 1. Inspection Time Requirement in Hours Per Week

	Up to $100,000			$100,000 to $500,000			$500,000 to $1Million			$1Million to $3Million			$3 Million and Greater		
	Navy	CQC Contractor	CQC Representative	Navy	CQC Contractor	CQC Representative	Navy	CQC Contractor	CQC Representative	Navy	CQC Contractor	CQC Representative	Navy	CQC Contractor	CQC Representative
Interpretation of the Plans and Specifications	4.1	4	6	8.2	33	(5)	10.6	10.7	(15)	14.7	19.1	19.3	19.2	31.6	29.2
Quality Control Inspection	18	3	(6)	22.6	26.3	(10)	29.4	23	(15)	33.4	27.3	29.3	42.6	29.1	36.3
Job Progress Inspection	4.4	2.1	(.5)	8.3	13.1	(1)	9.8	9.8	(1)	16.9	11.9	10.5	24.1	18	(40)
Total Requirement (hours/ week)	26.5	9.1	12.5	39.1	72.4	16	49.8	43.5	31	65	58.3	59.1	85.9	78.7	105.5

Note:

1. Circled values indicate only one response was received in that category.

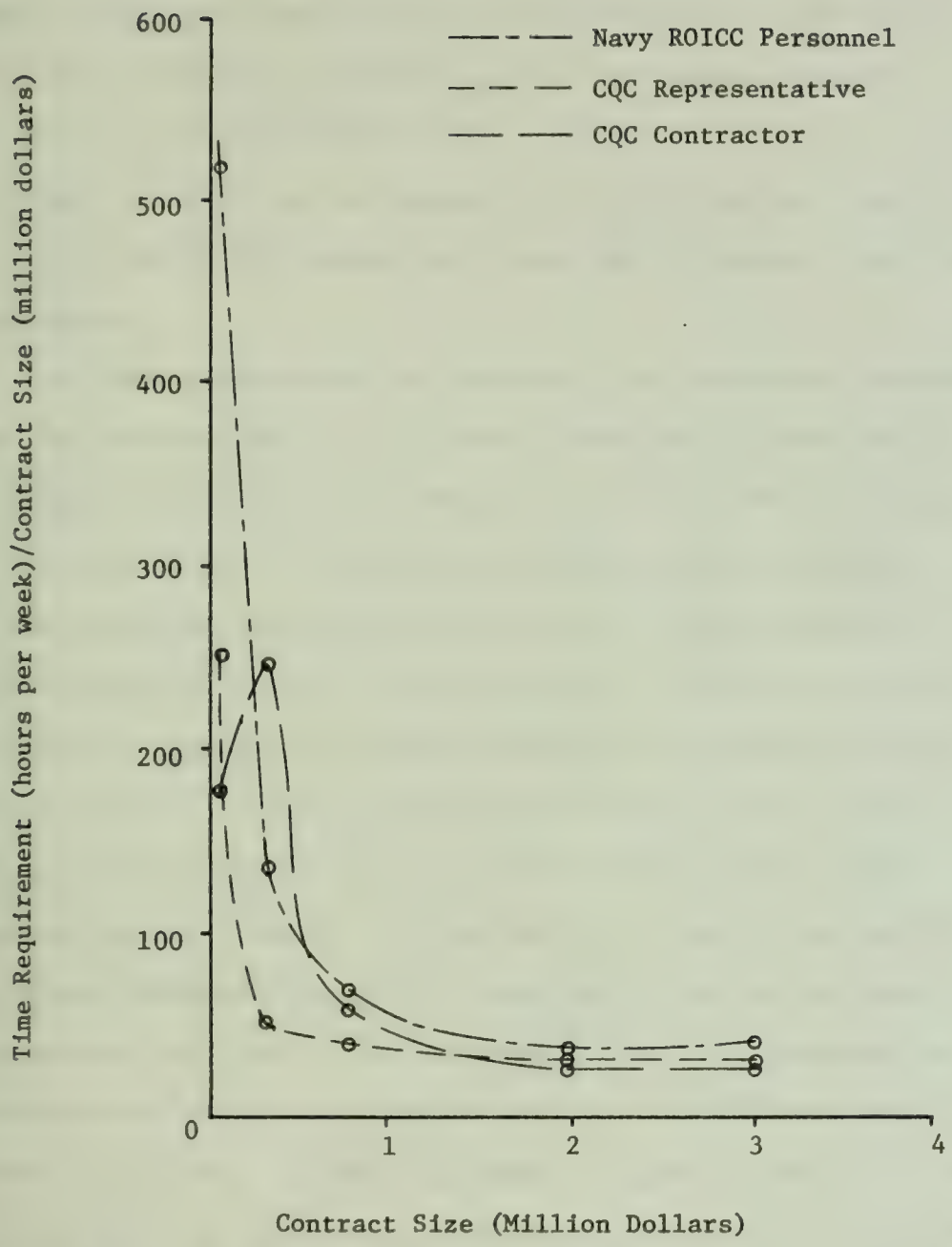
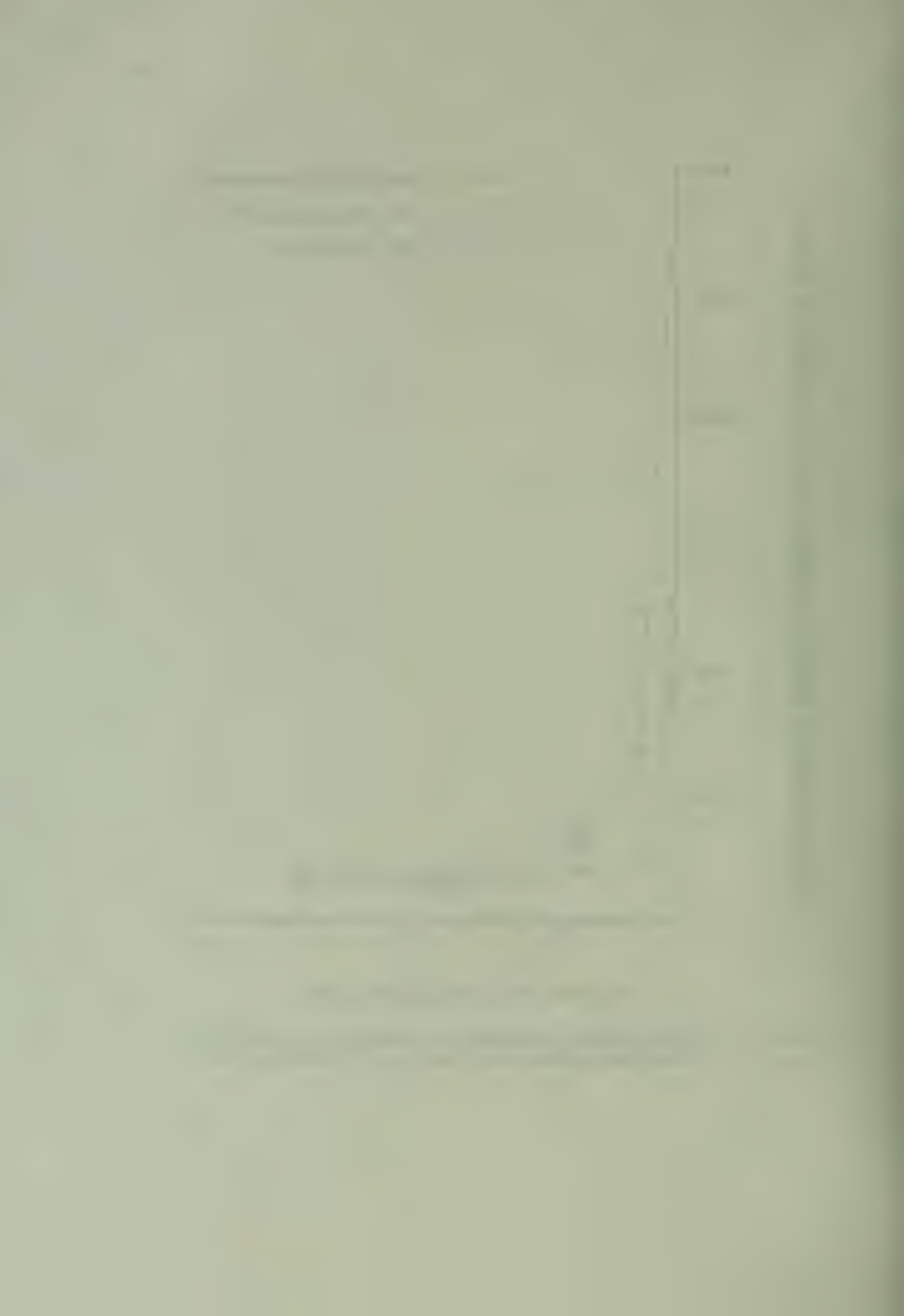


Figure 41 Navy Related Responses to Question 1. Inspection Time Requirement as a Function of Contract Size.



cost for inspection. In the range above one million dollars, all three groups are remarkably close in their hour per week values. The higher levels of inspection required for smaller contracts would be a significant portion of a contractor's bid. In that the estimates on these smaller contracts are often extremely precise, slightly varied CQC programs could make the difference in getting the award.

In order to determine the opinions of the respondents relating to the effectiveness of CQC, several questions were asked and the responses are illustrated in Figures 42 thru 50. The three groups feel that CQC "often" has given the contractor more freedom in controlling his own operations, and it has "often" reduced submittal approval time. To a lessor extent it has helped the contractor's organization recognize construction problems and solutions earlier. There is a difference of opinion over just how often CQC gets the job off to a smoother start. The CQC representatives feel that it is "often" while the contractors are more inclined to believe that it is "sometimes". The Navy personnel definitely feel that it is "simetimes". The CQC representatives are consistently the most enthusiastic group of the three while the Navy is the least. Although a mistake was made in asking the contractors the question concerning productivity, it can be concluded from the responses of the other two groups that CQC has either "often" (CQC representative) or "sometimes" (Navy personnel) increased job productivity. The opinions reflected in Figures 42 thru 46 indicate that CQC has benefited the Navy in varying degrees. The most significant conclusion that can be made after examining

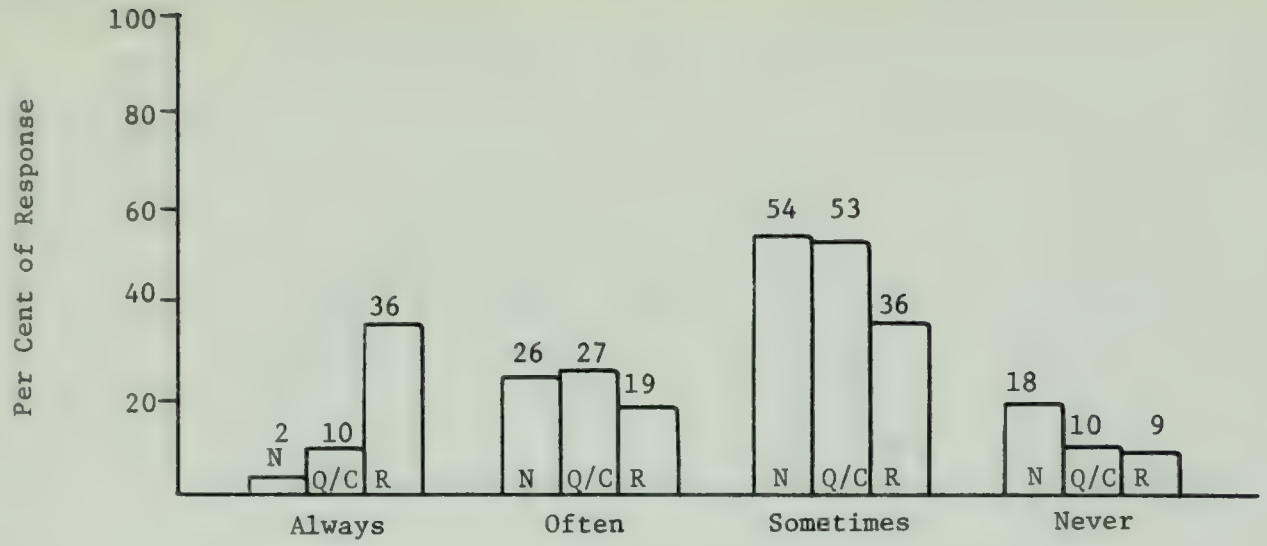


Figure 42 Responses from Navy Related Personnel to Question 4g. Navy and CQC Representative: Do you feel that CQC increases job productivity? Contractor: Do you feel that CQC ensures job productivity?

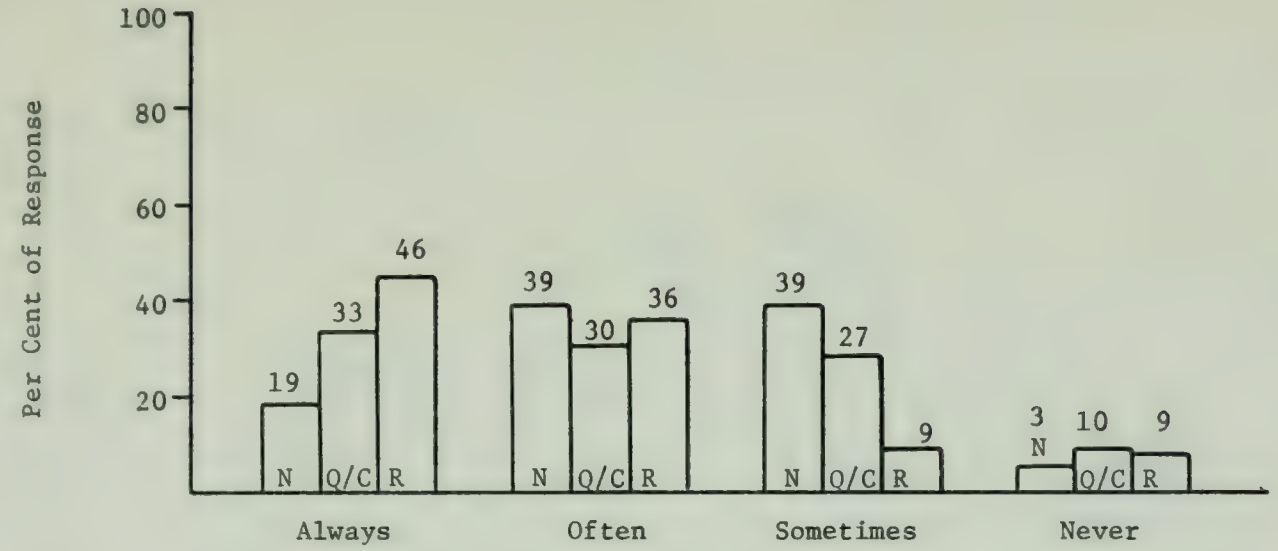


Figure 43 Responses from Navy Related Personnel to Question 4h. Do you feel that CQC reduces submittal approval time?

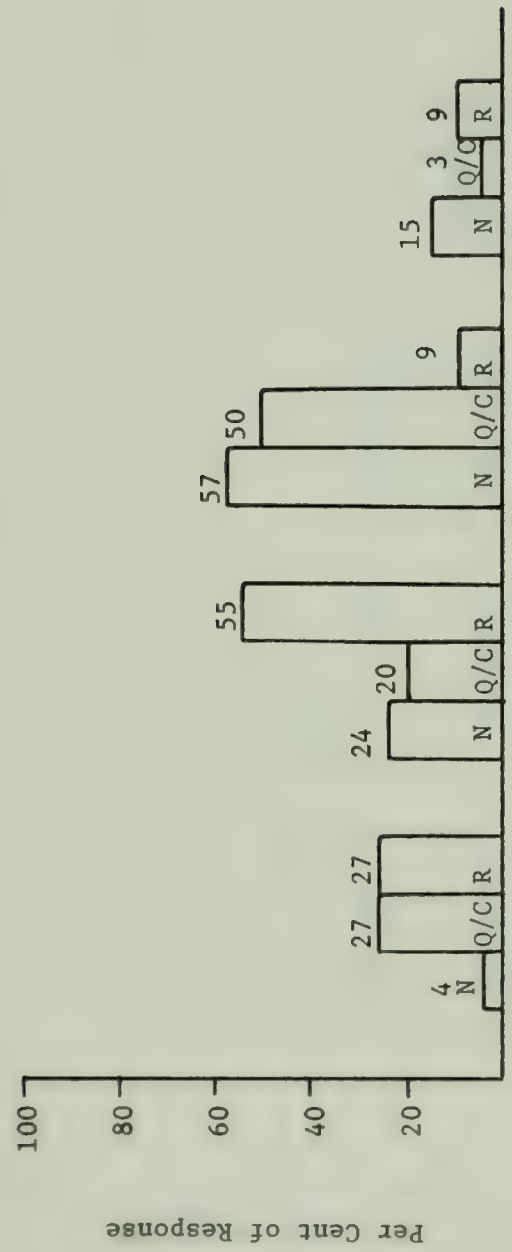


Figure 44 Responses from Navy Related Personnel to Question 4i. Do you feel that CQC gets the job off to a smoother start?

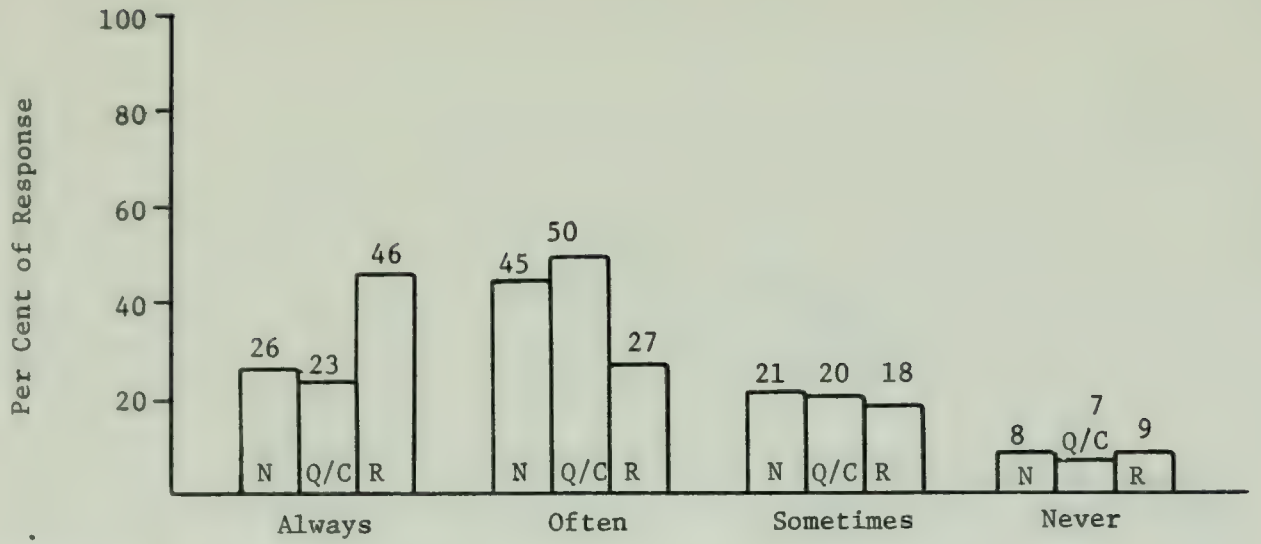


Figure 45 Responses from Navy Related Personnel to Question 4j. Do you feel that CQC gives the contractor more freedom in controlling his own operations?

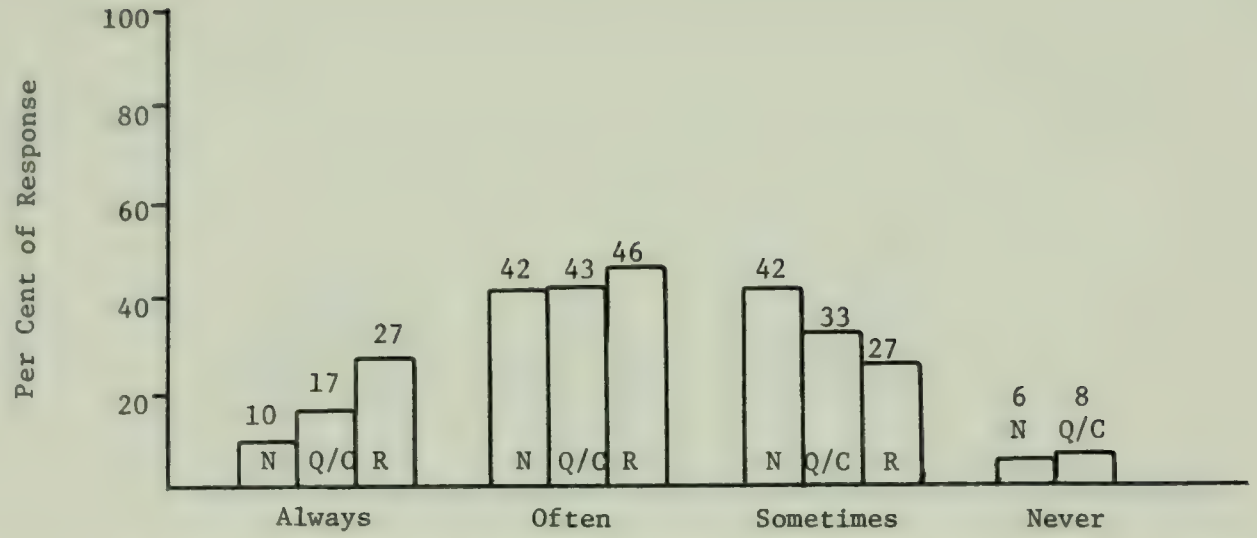
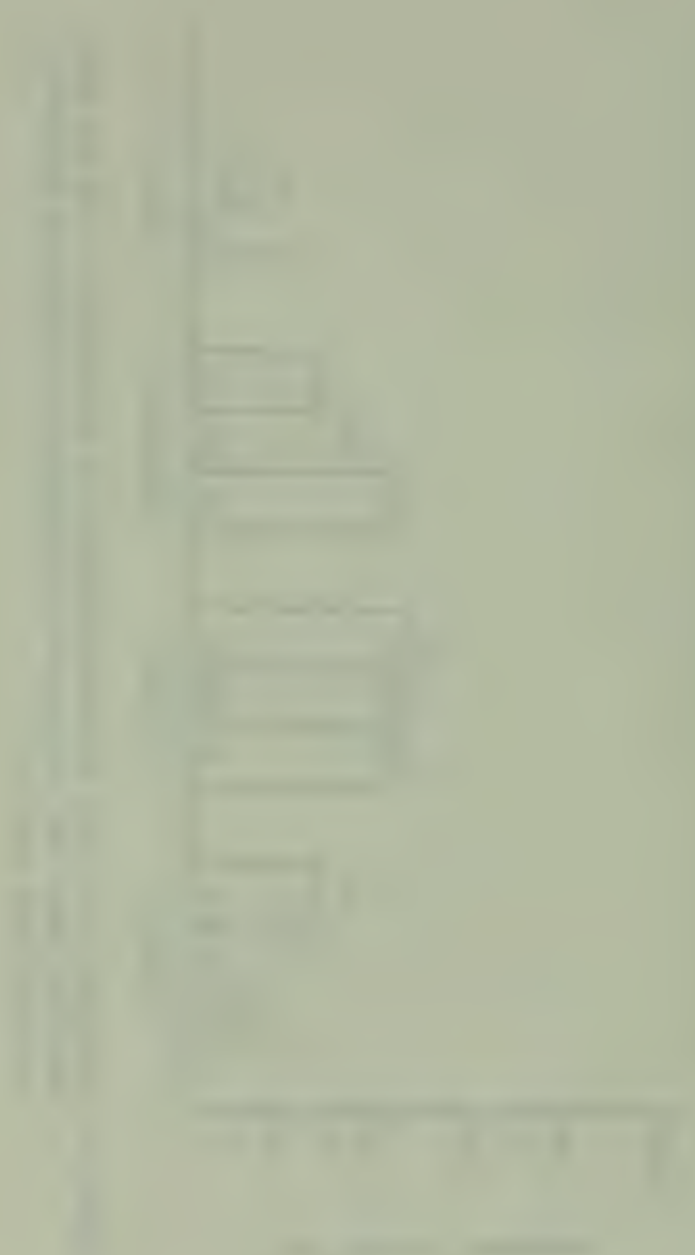


Figure 46 Responses from Navy Related Personnel to Question 4k. Do you feel that CQC helps the contractor to recognize construction problems and solutions earlier?



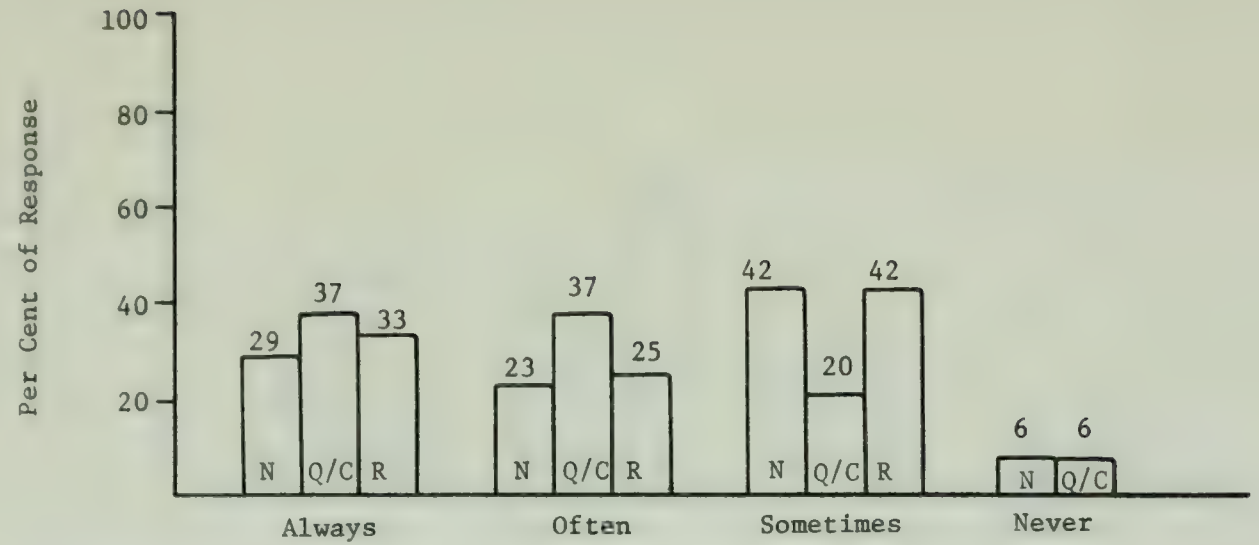


Figure 47 Responses from Navy Related Personnel to Question 8d. In considering past CQC contracts, do you think that the CQC plan is a valuable asset to the contractor's inspection program?

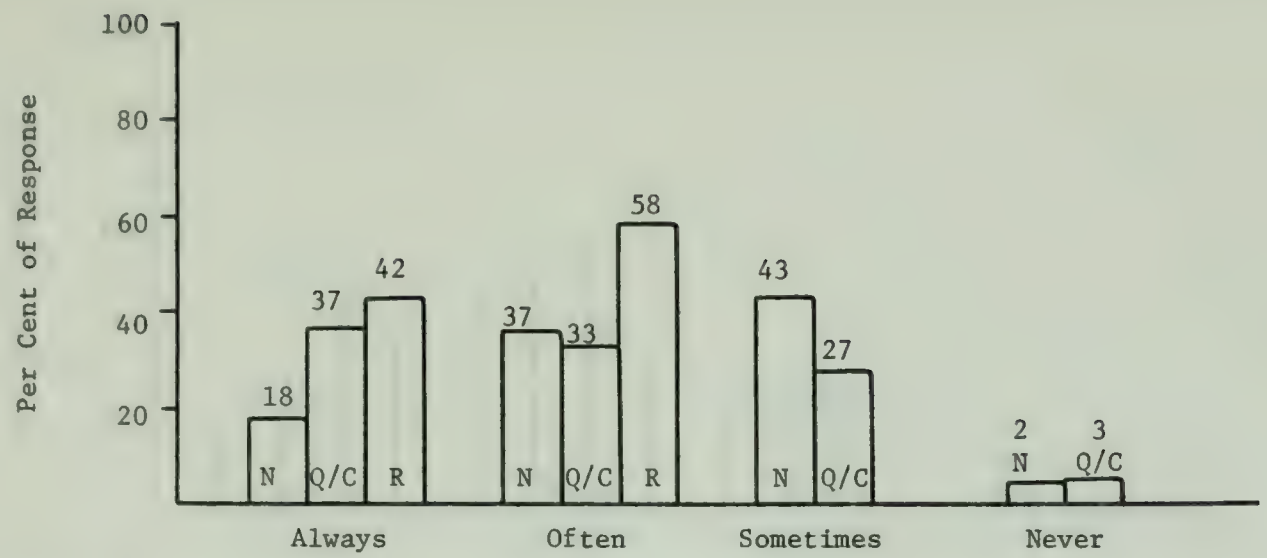


Figure 48 Responses from Navy Related Personnel to Question 8e. In considering past CQC contracts, do you think that the three stage inspection operation (preparatory, initial, follow-up) gives the contractor a satisfactory inspection program?

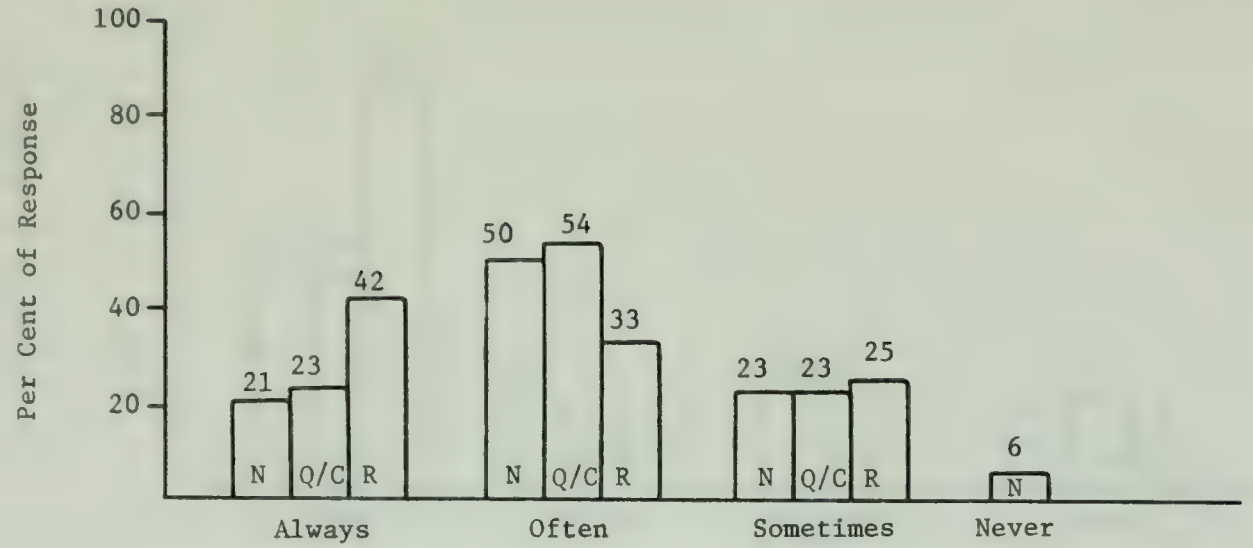


Figure 49 Responses from Navy Related Personnel to Question 8g. In considering past CQC contracts, do you think that the CQC requirements in the various divisions of the contract give the contractor enough information to plan a good CQC program?

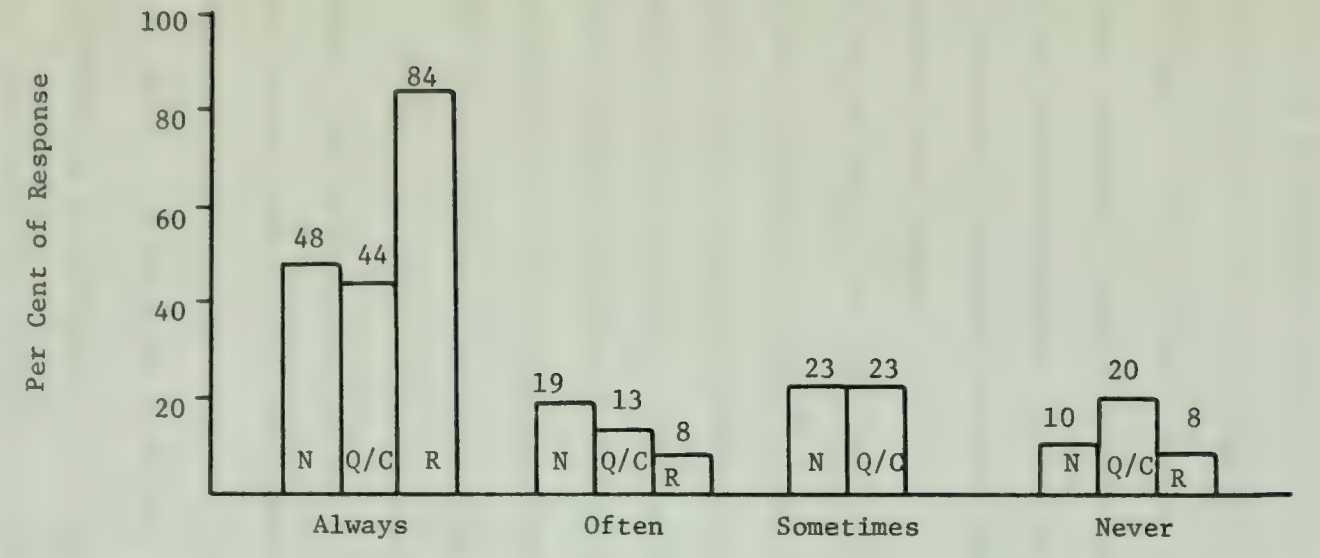


Figure 50 Responses from Navy Related Personnel to Question 8f. In considering past CQC contracts, do you think that the Navy should specify the number and qualifications of CQC personnel in the contract?

these five figures is that the opinions are diverse. The Navy personnel have responded primarily in the often and sometimes categories.

One of the intentions of the CQC program was to give the contractor back the control of his organization. This has happened frequently as is shown in Figure 45. An important facet of the three stage inspection program is the recognition of construction problems and solutions earlier. It can be concluded that this "often" occurs which can mean important monetary savings for both the contractor and the Navy.

The nonuniformity of the administration of the CQC program can also be seen in Figures 47 thru 50. The CQC representative and the Navy personnel have similar responses to the question concerning the benefits of the CQC plan. It can be concluded from Figure 47 that the CQC plan is only "sometimes" an asset to the program. The contractors and the CQC representatives have indicated from their responses concerning the three stage inspection process (see Appendix D), which includes the preparatory, initial, and follow-up inspections, that it is "often" effective. In addition, the respondents believe that the CQC requirements are often satisfactory for the planning of a good CQC program. It can be concluded from Figure 50 that the three groups want more specificity in the contract documents in the selection of CQC representatives. This is important to both the Navy and the contractor in having a well-defined inspection program. More specificity is particularly important to contractors in the preparation of bids for lump sum contracts. All three groups have shown, through their responses to

the questions illustrated in Figures 42 thru 50, that CQC has improved contract administration in the Navy.

The results of question two have been reproduced in Table XIX. In this question the respondents were asked to indicate who should be responsible for interpretation of the plans and specifications, quality control, job progress, and final acceptance inspections. The Navy respondents indicated that the contractor should not have the sole responsibility for the inspection, but in all four areas they want to share it with him. This indicates that the Navy respondents have recognized the importance of the contractors taking an active role on the inspection team. The CQC contractors have demonstrated that they want to have the sole responsibility for quality control inspection, and shared responsibility with the Navy for job progress inspection. They want the Navy to perform the final acceptance inspection, but they are uncertain as to who should interpret the plans and specifications. The CQC representatives believe that the contractor should perform the quality control inspection, and that he should share the responsibility for the final acceptance of the work. These results indicate that there is a significant feeling among the respondents that the contractor should be given part of the responsibility for the inspection. This was one of the goals of CQC.

All three groups were asked if they would prefer to have the Navy perform the inspection and delete the CQC provisions from the contract. Their responses are presented in Table XX. The mixed opinions that have been seen in the data could be attributed to the even division of the Navy personnel concerning CQC. In contrast,

Table XIX

Responses from Navy Related Personnel to Question 2.
Responsibility for Inspection and Quality Control[1]

	Responsibility Categories	Interpretation of the Plans and Specifications	Quality Control Inspection	Job Progress Inspection	Final Acceptance of Each Stage of the Work
Navy	Navy	24	18	28	34
	Contractor	2	30	6	6
	Shared: Contractor and Navy	51	49	65	53
	Someone other than the Contractor (excluding full Navy responsibility)	23	3	1	7
CQC Contractor	Navy	18	19	16	36
	Contractor	10	44	27	13
	Shared: Contractor and Navy	47	22	41	33
	Someone other than the Contractor (excluding full Navy responsibility)	25	15	16	18
CQC Representative	Navy	12	6	18	24
	Contractor	24	71	41	24
	Shared: Contractor and Navy	29	22	35	47

Table XIX (continued)

	Responsibility Categories	Interpretation of the Plans and Specifications	Quality Control Inspection	Job Progress Inspection	Final Acceptance of Each Stage of the Work
CQC Representative	Someone other than the Contractor (excluding full Navy responsibility)	35	1	6	5

Note:

1. All values presented as percentages of the total responses.

Table XX

Navy Related Responses to Question 11

Would you prefer to have the Navy perform the inspection and delete the CQC provisions from the contract?

Respondent Category	No	Yes
Navy	26	28
CQC Contractor	19	11
CQC Representative	10	2
Total No. Responses	55	41

the CQC representatives are conclusively in favor of retaining the CQC provisions as part of the contract. Sixty three percent of the contractors have indicated their satisfaction with CQC. Both the CQC representatives and the contractors feel that this program provides the Navy with better work than under the old NCIS program which is shown in Figure 51. Sixty one percent of the ROICC personnel also believe that CQC provides better work. On the question of a conflict of interest Contractor related respondents feel that this is a problem "sometimes". The Navy replies were indecisively distributed in the upper three categories which can be seen in Figure 52. Consistent with the trends shown in this analysis, ROICC respondents are divided on the question of whether or not the CQC representative can be on the contractor's payroll and properly inspect the work (Figure 53). The contractor related personnel continue to demonstrate a favorable attitude towards the CQC program, and they do not believe that there are any real problems in the areas discussed.

One of the new policies incorporated into the new CQC program adopted in January 1974 allows the CQC representative and the superintendent to be the same man on jobs that have an award value of less than $500,000. The respondents were asked to indicate their opinion of this policy. This can be seen in Figure 54. It can be concluded that the contractors would like this limit to be raised to $1 million while the Navy and CQC representatives are in agreement with the new limit of $500,000. In that the combination of these two functions represents a reduction in overhead for the contractor, he can bid more competitively on the contracts in this

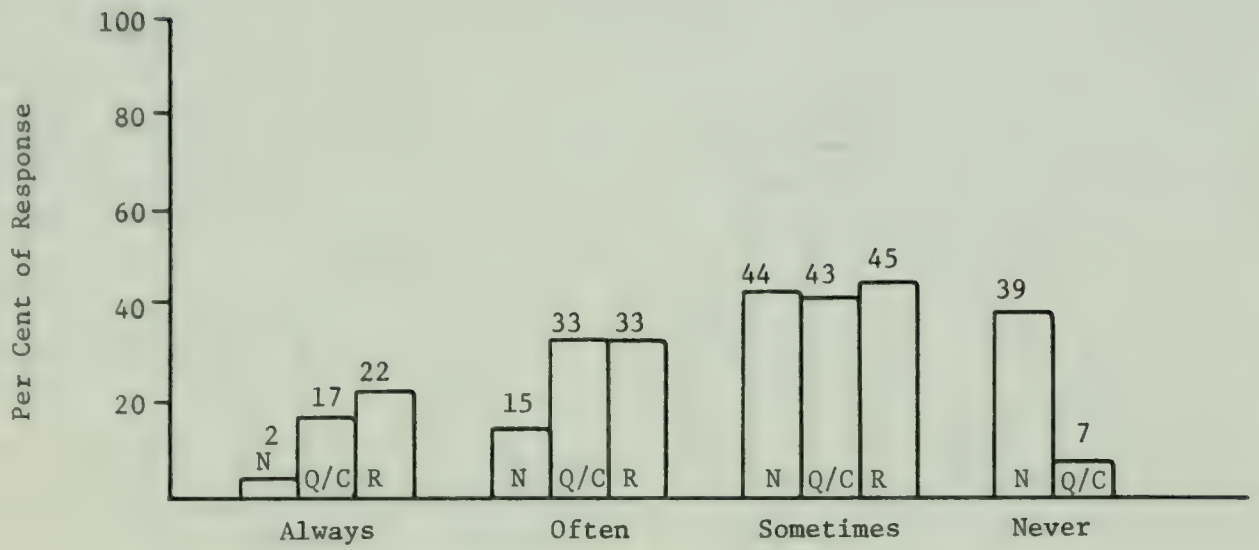


Figure 51 Responses from Navy Related Personnel to Question 41. Do you feel that inspection by the contractor gives the Navy a better completed job than under the old Navy Construction Inspection system?

Figure 52 Responses from Navy Related Personnel to Question 4m. Do you think that there is a conflict of interest because the contractor is inspecting his own work?

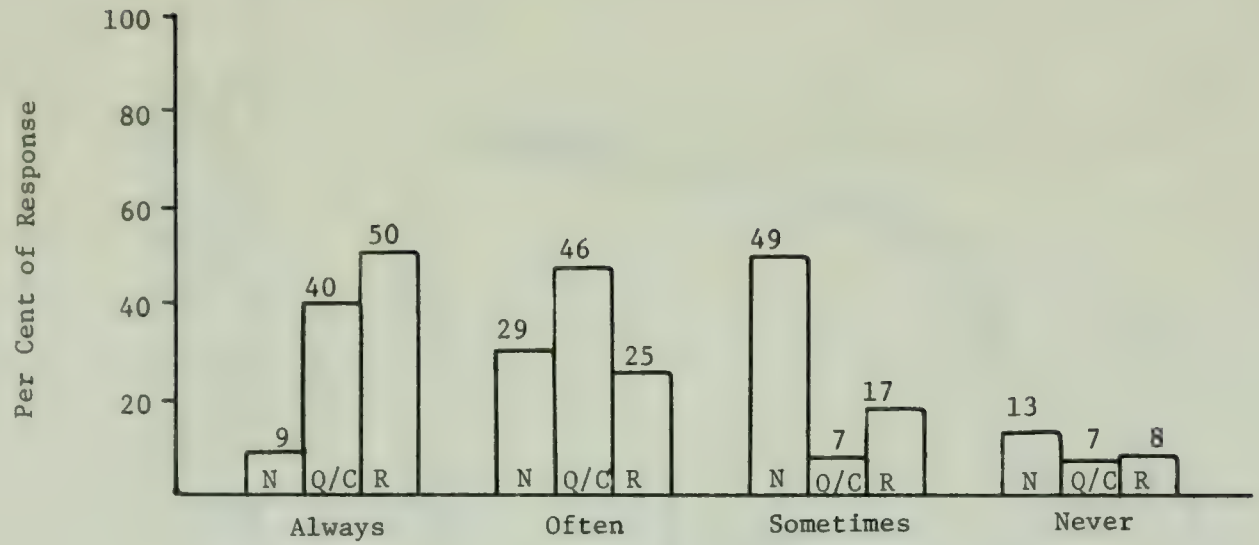


Figure 53 Responses from Navy Related Personnel to Question 8b. In considering past CQC contracts, do you think that the CQC Representative can be on the contractor's payroll and properly inspect the work?

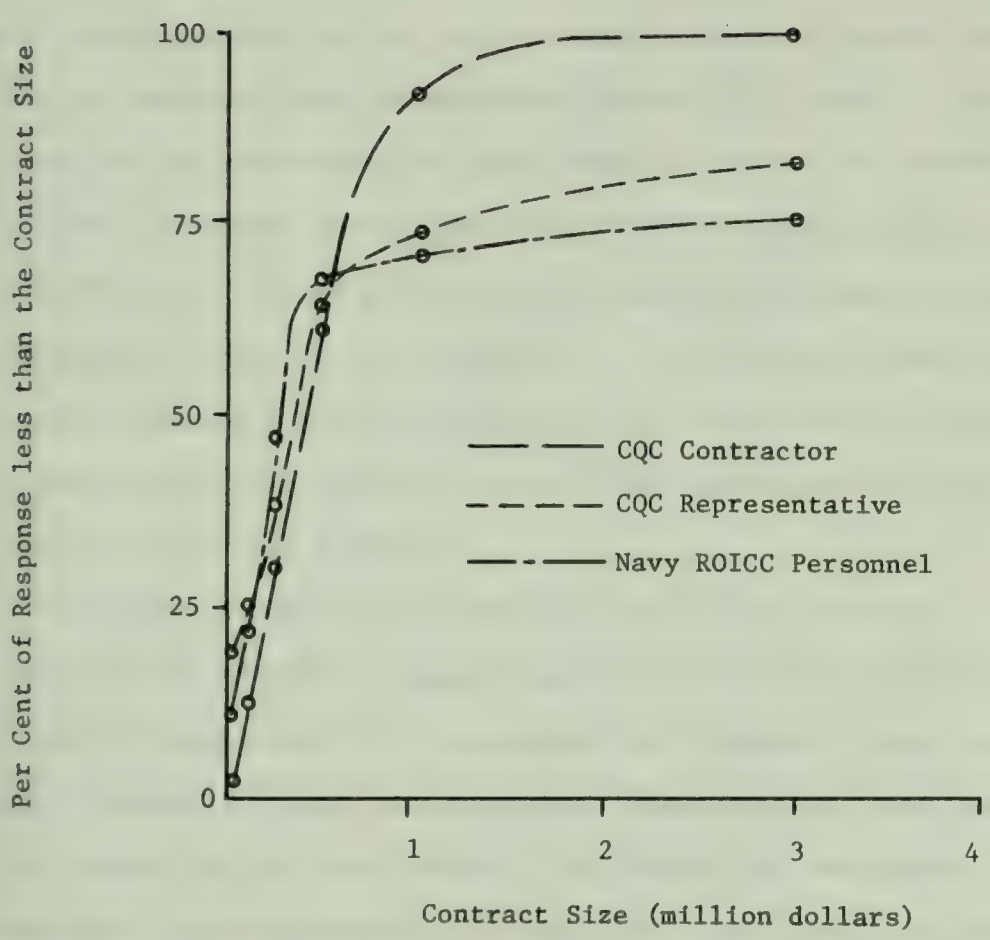


Figure 54 Navy Related Responses to Question 10 as a Function of Contract Size. (Question 10. At what contract dollar value should the job superintendent and the CQC representative be the same man?)

difficult range. This policy also removes the impartial observer who has previously performed the inspection. Inspection by the superintendent could represent a conflict of interest. All three groups of respondents have indicated that many of the contractors who handle the work in this range provide a level of quality which is less than that which is specified (Table XVII). This is supported by the much higher relative costs for inspection required for small contracts (see Figure 41). These conclusions indicate that the use of CQC on contracts less than $500,000 might place an unnecessary burden on the contractor. If contractors in this range typically do not provide the quality that is specified, the finished projects may not justify the use of CQC on Navy construction contracts less than $500,000.

It can be concluded from Figures 55 and 56 that CQC could "often" be successful on nongovernment work and in the area of construction management. All three groups are remarkably close in their opinions on these two questions. These opinions imply that the benefits of CQC have favorably influenced the respondents. The results of the responsibility for inspection question (Table XIX) demonstrates an awareness of the importance of contractor participation in inspection and quality control. The success of the CQC program has been to reduce delays (Figure 43), to give the contractor more freedom in the control of his own operations (Figure 45), and to recognize construction problems and solutions earlier (Figure 46). The three stage inspection procedure and the CQC requirements in the contract documents appear to be effective assets to the program. Before a conclusion can be made about the

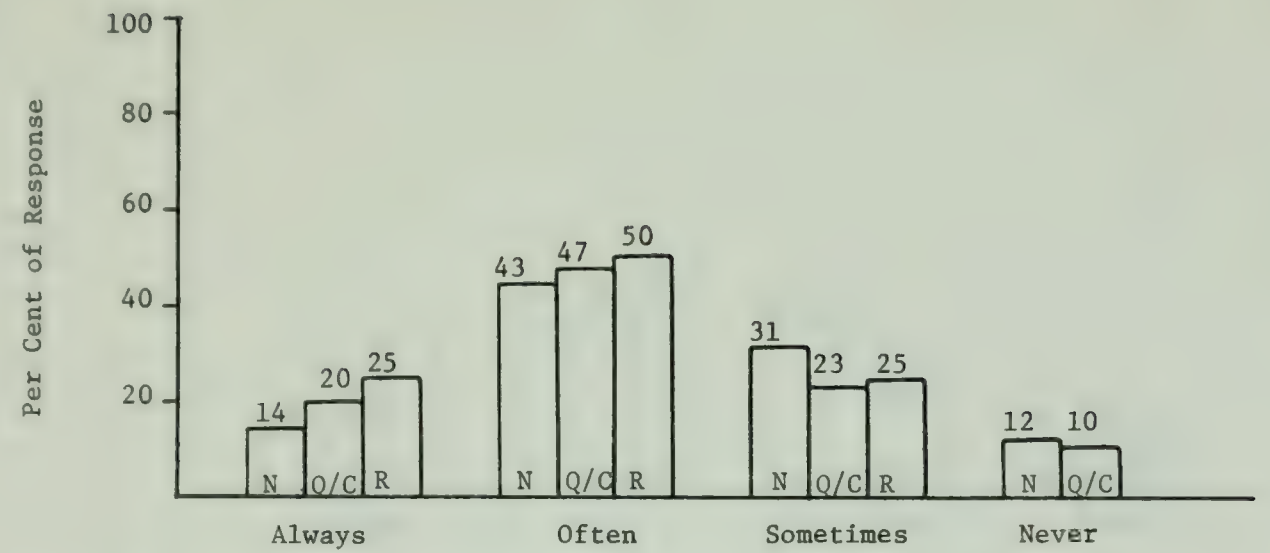


Figure 55 Responses from Navy Related Personnel to Question 8h. In considering past CQC contracts, do you think that a program like CQC could be used on nongovernment jobs?

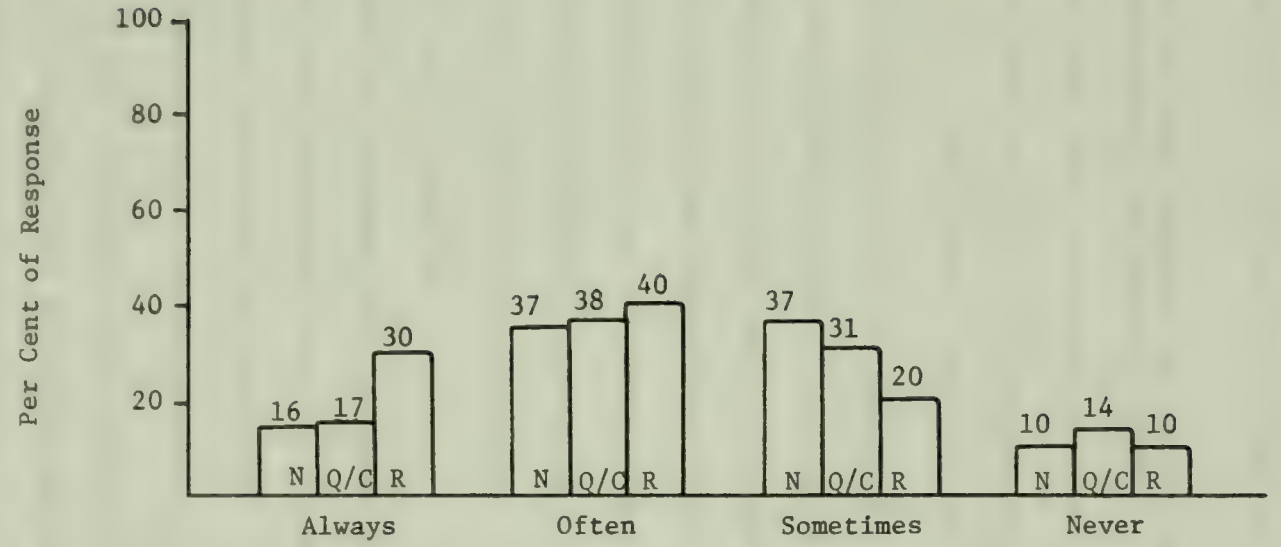


Figure 56 Responses from Navy Related Personnel to Question 4n. Do you think that contractor inspection lends itself to a Construction Management type of contract?

success of CQC, it is important to determine why forty three percent of the respondents wanted to return all of the responsibility for the inspection to the Navy contract administrators. These reasons will be developed in the next two sections.

Section 5a. Navy Personnel Who Want to Delete the CQC Provisions from the Contract and Return to NCIS

The twenty eight respondents in this group indicated that they want to return to NCIS and delete the CQC provisions from the contract by responding "Yes" to Question 11. On the bar graph figures in this section they will be referred to as "Y" (see Table V).

It can be seen in Figure 57 that this group feels that ROICC personnel have had a high regard for inspection. Although they "always" like to have inspection on their jobs, it can be concluded from Figures 59, 60, and 61 that it does not "always" ensure quality and find mistakes. They place more confidence in inspection as a tool to ensure that the contractor provides the level of quality that is specified.

These Navy personnel have indicated that their regard for CQC has been good "sometimes", which is a lower rating than the other respondents have shown (see Figure 58). According to the results illustrated in Figure 62, they rarely overinspect CQC jobs. Both groups of Navy respondents have indicated that the satisfactory levels of inspection are about the same on contracts above $300,000 (see Appendix K), and yet, the other group feels that the Navy overinspects the CQC jobs more often.

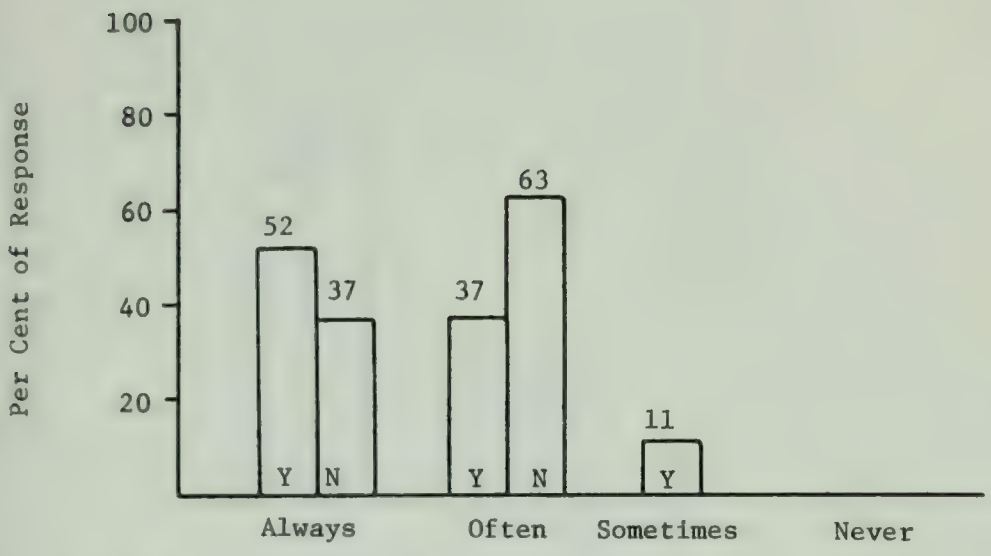


Figure 57 Responses from Navy Personnel to Question 3a. Do you feel that the Navy ROICC office personnel that you have worked with on CQC jobs have had a good regard for inspection?

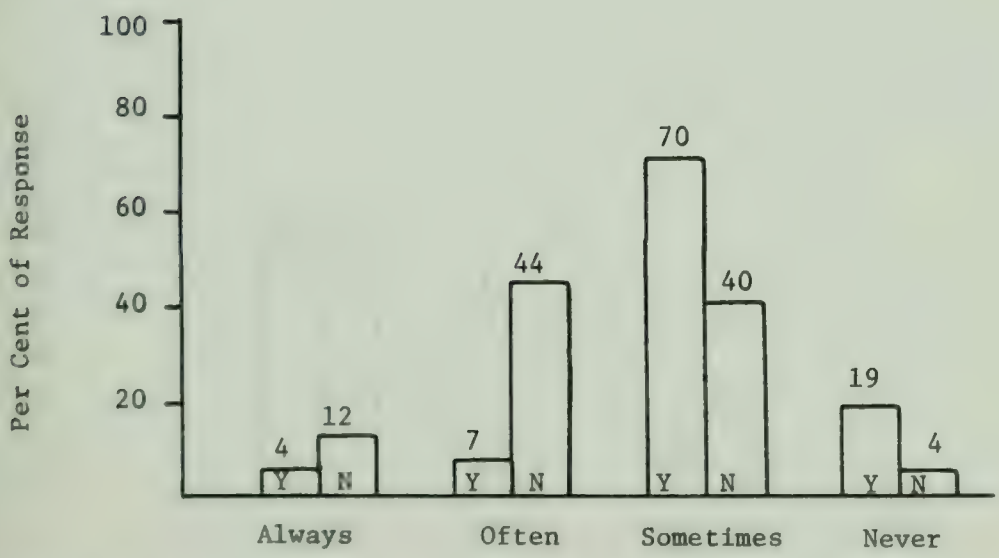


Figure 58 Responses from Navy Personnel to Question 3e. Do you feel that the Navy ROICC office personnel that you have worked with on CQC jobs have had a good regard for the CQC program?

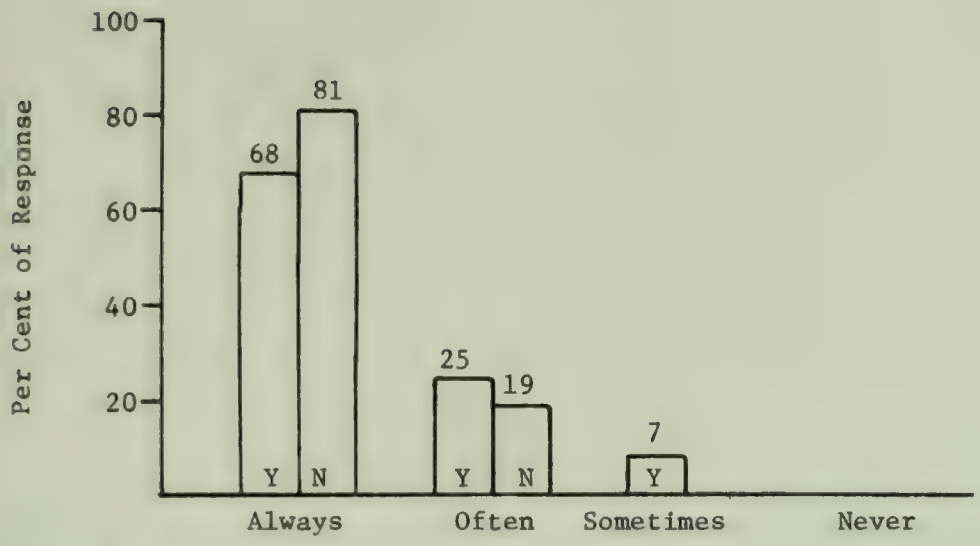


Figure 59 Responses from Navy Personnel to Question 4a. Do you feel that inspection is a good tool to ensure that the contractor provides the level of quality specified in the contract?

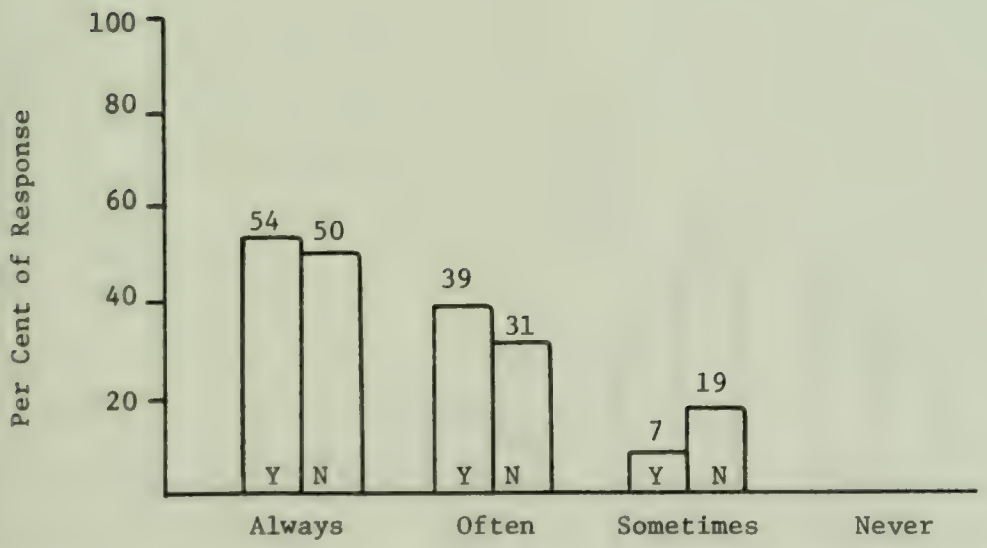


Figure 60 Responses from Navy Personnel to Question 4b. Do you feel that inspection is a good tool to help even the best of contractors find mistakes?

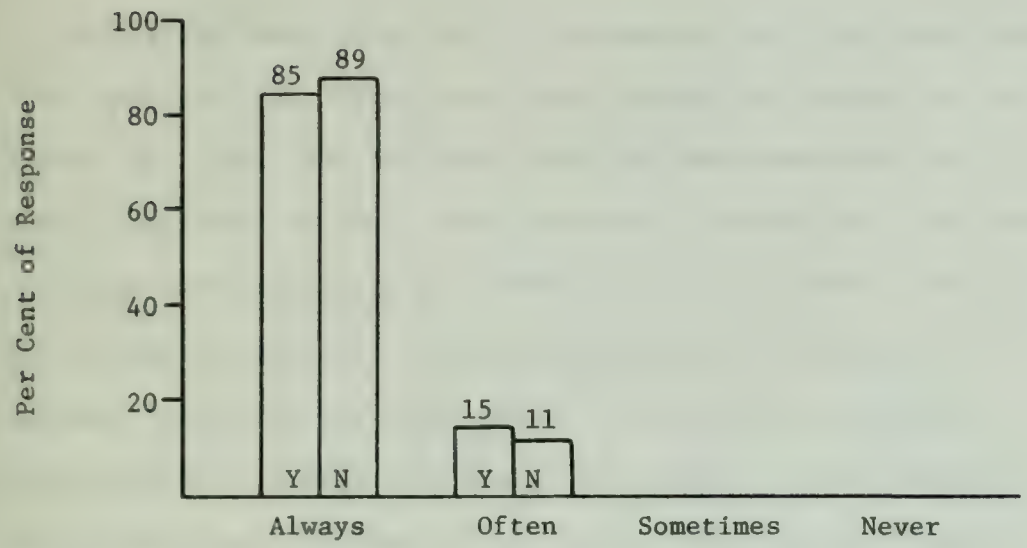


Figure 61 Responses from Navy Personnel to Question 4c. Do you feel that inspection is a service that you like to have on your jobs?

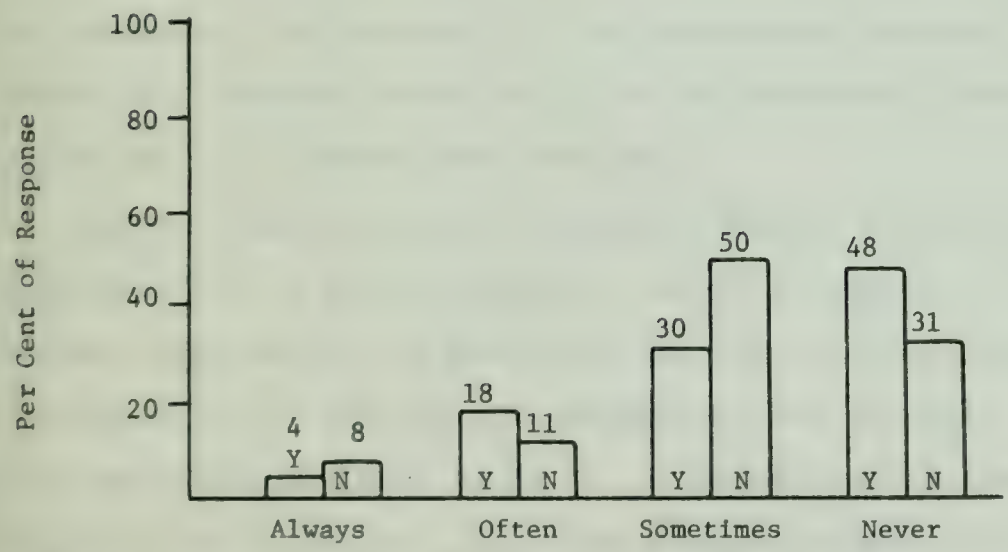


Figure 62 Responses from Navy Personnel to Question 8c. In considering past CQC contracts do you think that the Navy overinspects its CQC jobs?

This group feels that the CQC contractors that they have worked with, have only "sometimes" had a good regard for inspection (see Figure 63). They also feel that good CQC representatives are usually difficult to find. This is shown in Figure 64. This group responded consistently in the "sometimes" category when asked if the contractor furnished satisfactory inspection, which was one category lower than the other group. It can be concluded from Figures 65 thru 68 that this group feels that the major benefits of CQC are in more freedom for the contractor in controlling his own operations and in getting the job off to a smoother start. In contrast, CQC rarely helps the contractor recognize construction problems and solutions earlier. They are divided on the adequacy of the three stage inspection program. They definitely feel that the Navy should always specify the numbers and qualifications of the contractor's CQC personnel. It can be concluded from these results that this group feels that CQC is only sometimes a satisfactory method of contract administration.

Contractor quality control, according to the Navy personnel responding "Yes" to question eleven, is "often" too expensive to provide. They feel that it never gives the Navy a better completed job than NCIS. The other group's responses are more favorable. This can be seen in Figures 69 and 70. It can be concluded from Figures 71 and 72 that this group feels that CQC represents a conflict of interest in which the CQC representative can only sometimes properly inspect the work and get paid by the contractor. Another interesting result is shown in Table XXI. According to this group of Navy personnel, the contractors that they have worked

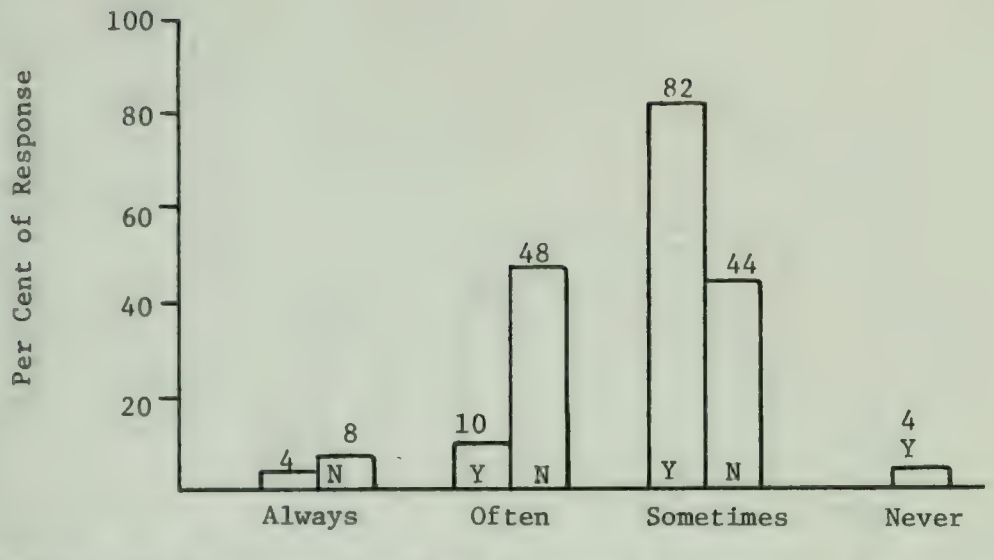


Figure 63 Responses from Navy Personnel to Question 9a. Do you feel that the CQC Contractors that you have worked with have had a good regard for inspection?

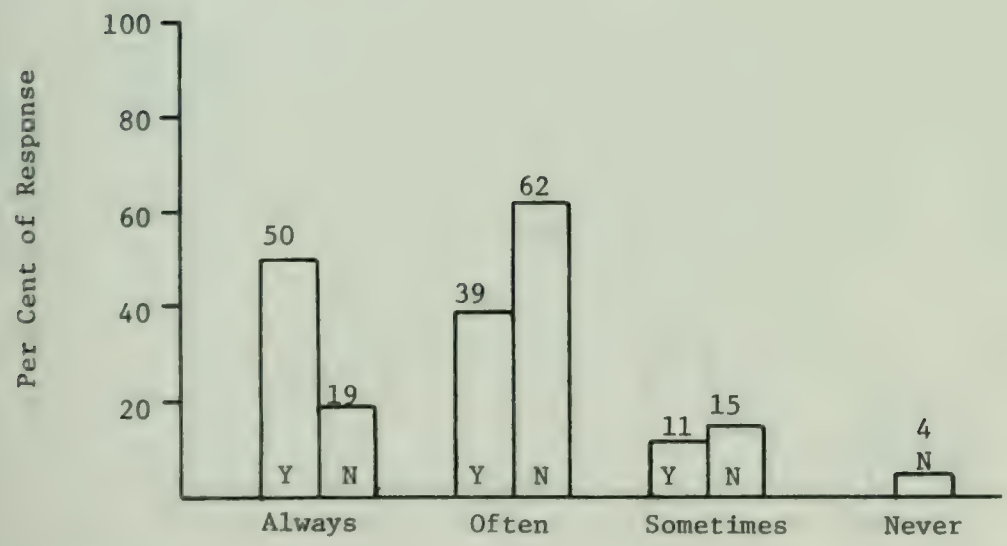


Figure 64 Responses from Navy Personnel to Question 4f. Do you feel that good CQC Representatives are difficult to find?

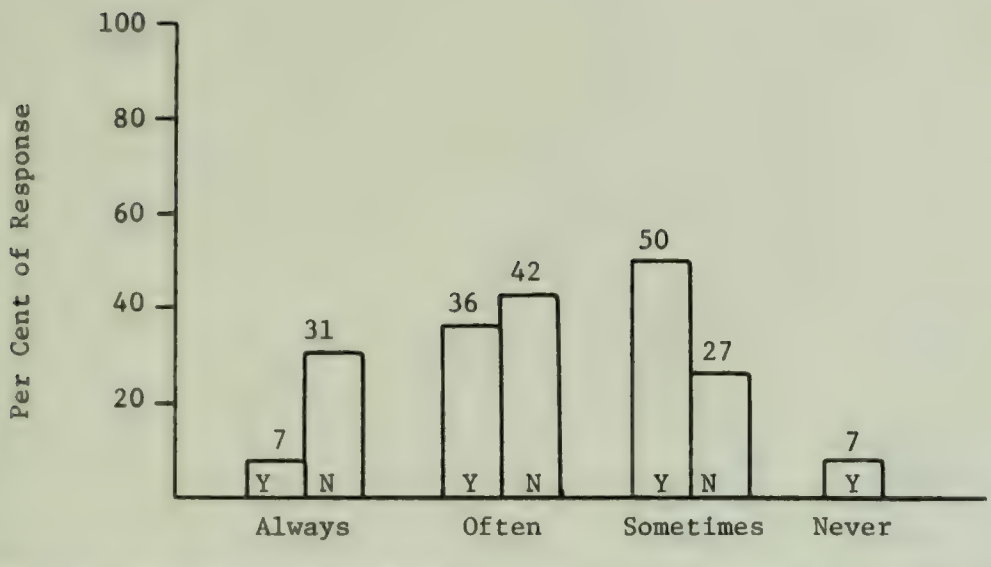


Figure 65 Responses from Navy Personnel to Question 4h. Do you feel that CQC reduces submittal approval time?

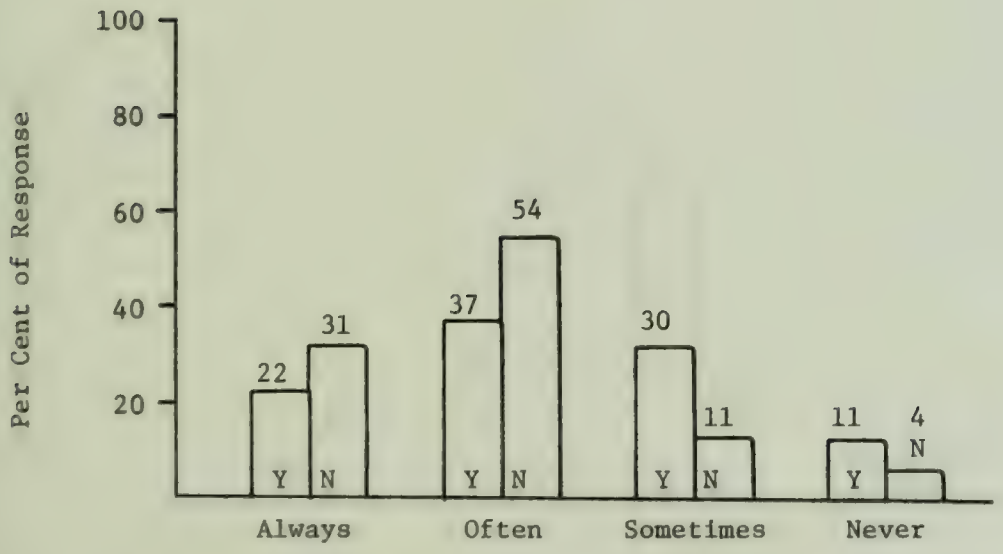


Figure 66 Responses from Navy Personnel to Question 4i. Do you feel that CQC gets the job off to a smoother start?

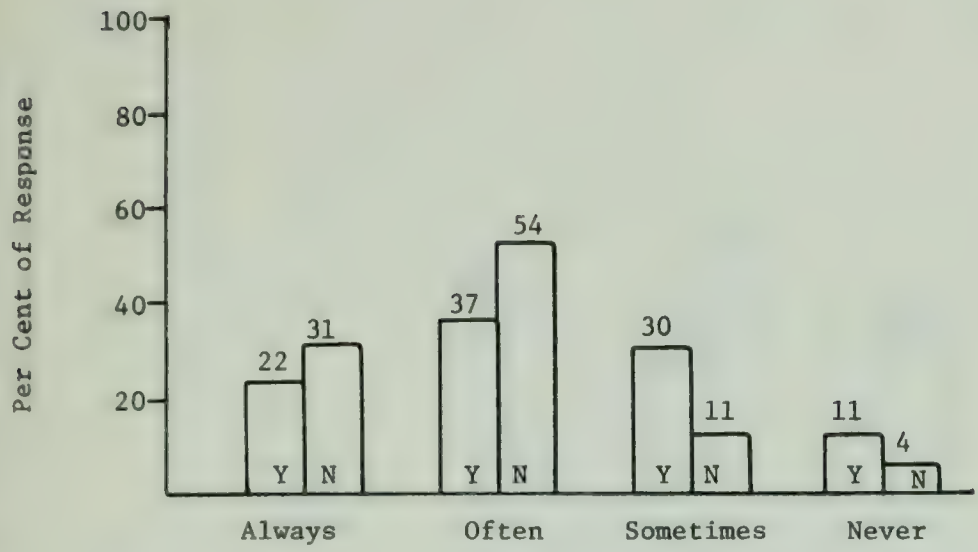


Figure 67 Responses from Navy Personnel to Question 4j. Do you feel that CQC gives the contractor more freedom in controlling his own operations?

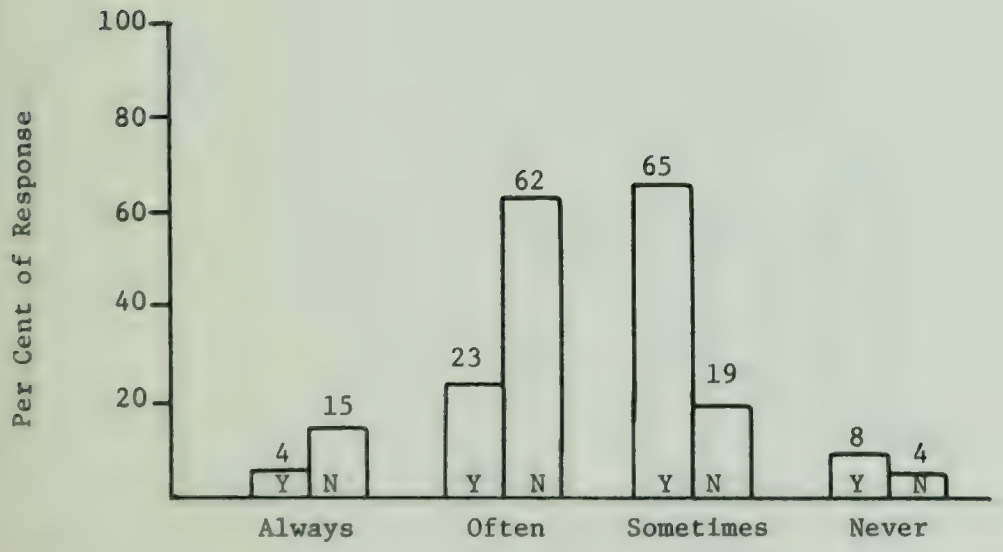


Figure 68 Responses from Navy Personnel to Question 4k. Do you feel that CQC helps the contractor to recognize construction problems and solutions earlier?

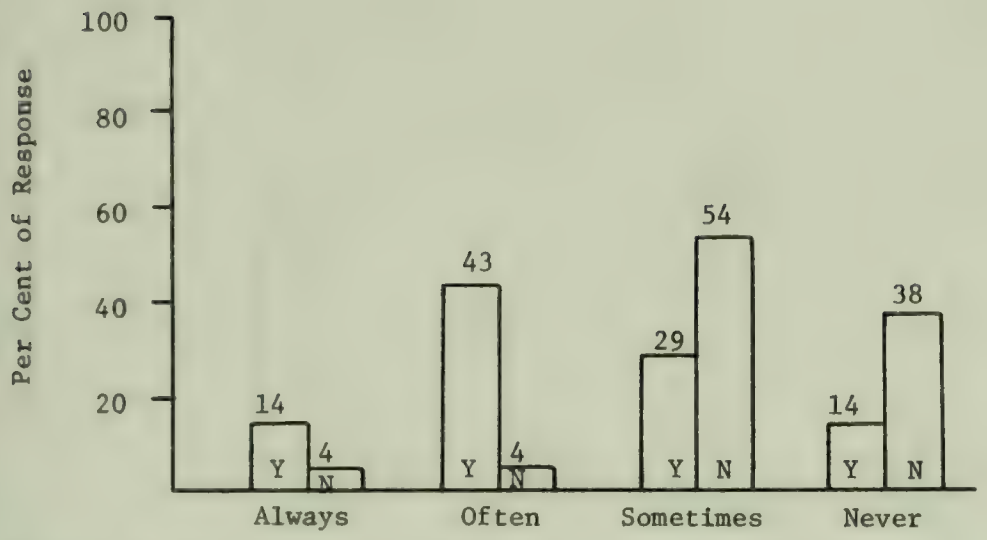


Figure 69 Responses from Navy Personnel to Question 4d. Do you feel that the cost of a satisfactory CQC program is too expensive to provide?

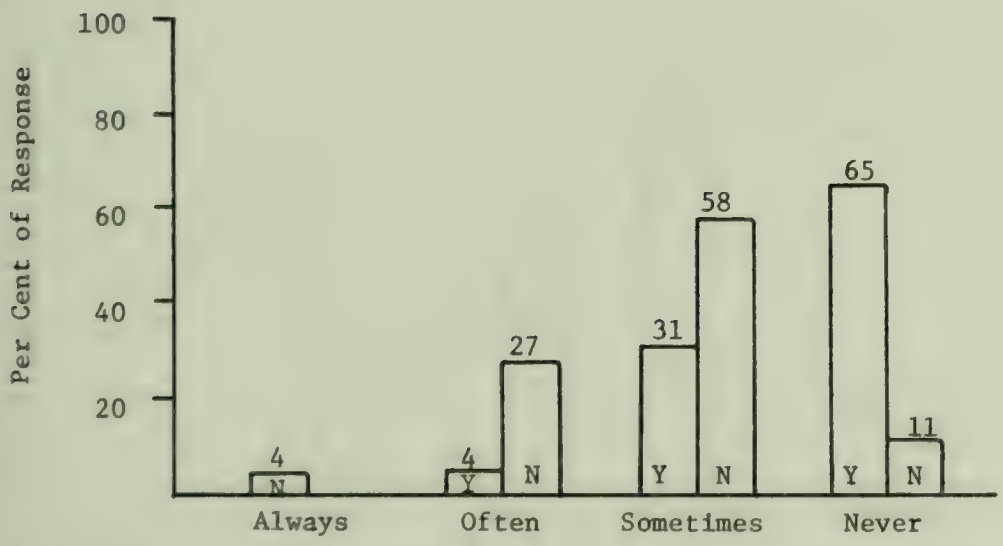


Figure 70 Responses from Navy Personnel to Question 41. Do you feel that inspection by the contractor gives the Navy a better completed job than under the old Navy Construction Inspection System?

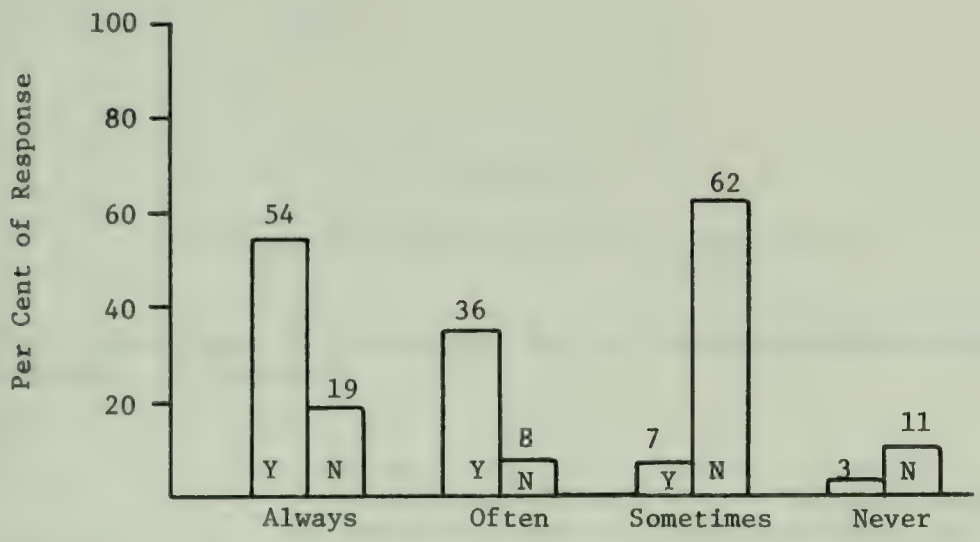


Figure 71 Responses from Navy Personnel to Question 4m. Do you feel that there is a conflict of interest because the contractor is inspecting his own work?

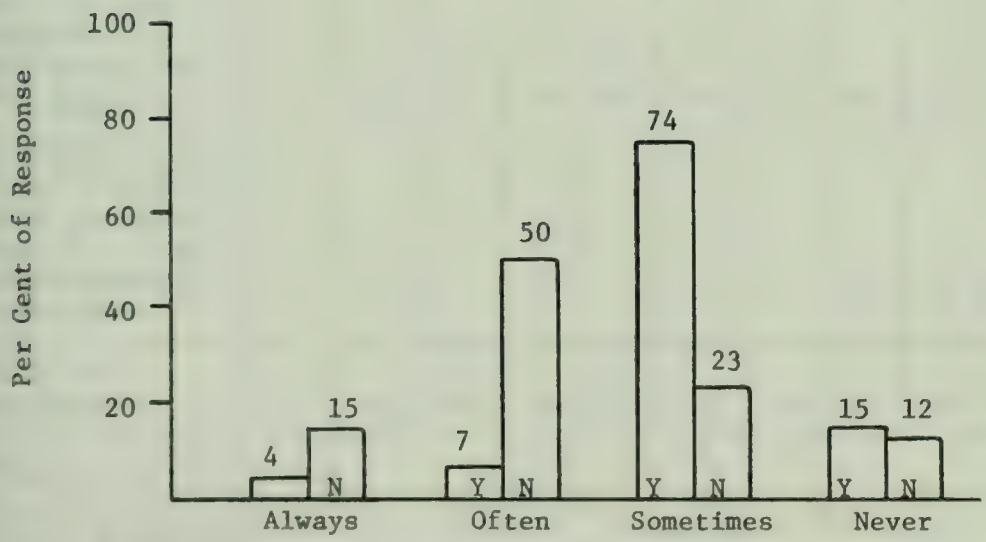


Figure 72 Responses from Navy Personnel to Question 8b. In considering past CQC contracts, do you think that the CQC Representative can be on the contractor's payroll and properly inspect the work?

Table XXI

Responses from Navy Personnel to Question 5

To your knowledge, do contractors in the following categories have a tendency to provide:[1]

	Up to $100,000 per award		Up to $500,000 per award		Up to $1Million per award		Up to $3Million per award		Unlimited per award	
	Y[1]	N	Y	N	Y	N	Y	N	Y	N
a) Just enough Quality Control to get by	100	89	100	60	82	39	60	30	67	14
b) Level of Quality Control that is required by Plans & Specifications as interpreted by the ROICC	-	11	-	40	14	56	33	52	28	45
c) Level of Quality Control that is higher than (b) to enhance company reputation	-	-	-	-	4	5	7	17	5	41
Total No. Responses	12	18	16	20	22	18	30	23	18	22

Note:
1. The values for a,b,c are expressed as a percentage of the Total No. of Responses
2. For an explanation of "Y" and "N" see Table V

with in all of the ranges primarily do work that is less than specified. Apparently there are several implications as to why this group dislikes contractor quality control. The consistently low regard that they have for the contractor's inspection system and the level of quality that he typically provides is an indication that there is a certain amount of friction involved in the administration of CQC contracts. They feel that there is always a conflict of interest with CQC and that good CQC representatives always are difficult to find. They also believe that he can only "sometimes" work for the contractor and properly inspect the work. Surprisingly enough, they feel that the contractor should share the responsibility for the inspection with the Navy in the areas of job progress and quality control. It would appear that they feel that the contractor has been given too much responsibility, and, as a result of their reservations, they want to become more involved in the inspection function. Originally, the CQC program substituted the word surveillance for the word inspection. There has been much misunderstanding as to just what surveillance meant. That misunderstanding has been one of the reasons for the nonuniformity in the application of CQC, according to many of the interviews and comments that have been received. Many of the specific questions concerning the CQC program reflect a diversity of opinions. An example can be seen in the question concerning the three-stage inspection program (Always: 16%, Often: 40%, Sometimes: 40%, Never: 4% - see Appendix L).

These opinions can have a very significant affect on the success or failure of a CQC contract. The overall low regard that both groups have stated exists by Navy personnel towards CQC is important to this discussion. This obvious dissatisfaction can negatively affect office morale and eventually the total success of CQC. The division of the Navy respondents which is illustrated in Table XXII indicates that the CQC program is still in the early stages of acceptance. The civilian respondents dislike CQC two to one while the officer personnel like it three to two. It can be seen in Figures 73 and 74 that the nongovernment application of CQC could work "often" in a more controlled situation like construction management. They do not feel that CQC would be very successful on civilian work. It can be concluded that contractor responsibility for the inspection could be easily used in negotiated work where the contractor is selected for his ability and reputation.

Section 5b. Navy Personnel Who Want to Retain the CQC Provisions as Part of the Navy Contracts

The twenty six respondents in this group indicated that they wanted to continue with the CQC program by answering "No" to Question 11 (see Table V). On the bar graph figures in this section they will be referred to as "N".

According to this group, inspection is a function that they always like to have on their work and that it ensures quality and finds mistakes (see Figures 59 thru 61). This group holds a higher opinion of the regard that contractors have for inspection (see Figure 63). This is reflected in the other questions that were

Table XXII

Civil Service/Officer Breakdown of the Navy Respondents According to Question 11 Replies

Officer	Y[1]	Per Cent	N	Per Cent
Ensign	2	7	2	8
Lieutenant(jg)	5	18	1	4
Lieutenant	2	7	5	19
Lt.Commander	2	7	8	31
Commander	1	4	2	8
Captain	-	-	1	4
Civil Service				
GS-9	4	14	1	4
GS-11	2	7	1	4
GS-12	7	25	1	7
GS-13+	1	4	2	7
Other Civil Service	2	7	1	4
Total	28	100	26 (25)	100

Note:

1. For an explanation of "Y" and "N" see Table V.

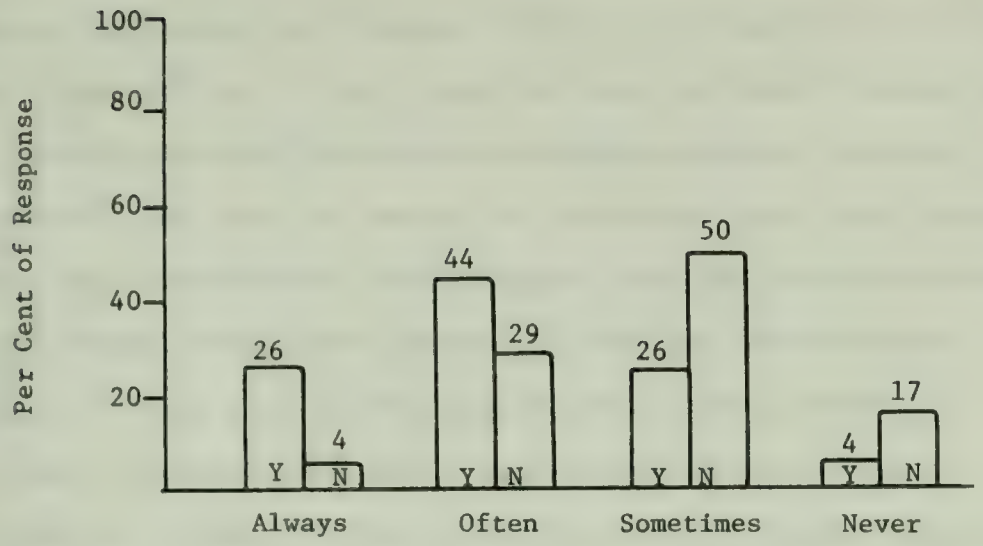


Figure 73 Responses from Navy Personnel to Question 4n. Do you think that contractor inspection lends itself to a Construction Management type of contract?

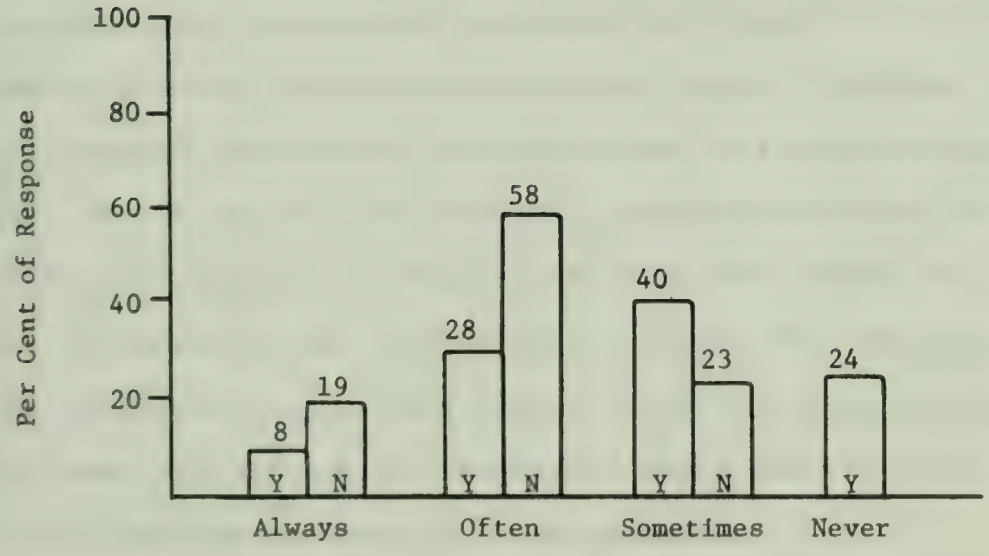


Figure 74 Responses from Navy Personnel to Question 8h. In considering past CQC contracts, do you think that a program like CQC could be used on nongovernment jobs?

asked concerning this program. Their diverse responses illustrated in Figures 65 thru 67 imply that CQC is not uniformly administered. It can be concluded that this program often reduces submittal approval time, gets the job off to a smoother start, gives the contractor more freedom in controlling his own operations, and helps the contractor recognize construction problems and solutions earlier. They like the CQC plan, but they have a mixture of opinions concerning the three stage inspection program (see Appendix L). They are also divided between the four categories on the question of whether or not the Navy should specify the numbers and qualifications of CQC personnel (see Appendix L). It would appear that this group would also like more guidance from NAVFAC about CQC personnel.

In their evaluation of CQC, they have indicated that it is only sometimes too expensive to provide (see Figure 69). They feel that it gives the Navy a better completed job only "sometimes". This response implies that this group is not fully satisfied with CQC. They do not feel that there is a significant problem with conflict of interest. It follows that they would believe that the CQC representative can properly inspect the work while being on the contractor's payroll (see Figures 71 and 72). They also have indicated that the contractors who they have worked with often provide satisfactory inspection (see Appendix M).

The significantly higher regard that these respondents have for the level of quality that contractors typically provide can be seen in Table XXI. Contractors who normally perform jobs that are greater than $500,000 typically provide work that is equal to or

greater than the specified quality. They do not feel that CQC is very applicable to construction management, but its use on non-government work could often be successful which is shown in Figures 73 and 74.

This group of Navy personnel have indicated favorable opinions about the CQC program. There is a level of respect for the contractor that can be seen in many of the results. They feel that the contractor has done a good job of fulfilling his responsibilities. They feel that CQC is a better method of contract administration than NCIS, although they have implied that it could be improved. They stated that CQC only "sometimes" provides a better completed job than NCIS (see Figure 70). It can be concluded that this group of Navy personnel would like to see an improvement in the methods of performance of inspection by the contractor and a clarification of the status of the CQC representative. Some of the diverse responses would indicate that NAVFAC needs to clarify the CQC program in order to make its application more uniform.

Section 6a. Contractors Who Want to Delete the CQC Provisions from the Contract and Return to the Responsibility for the Inspection to the Navy

There are eleven respondents in this group who indicated that they wanted to have the Navy delete the CQC provisions from their contracts and perform the inspections by responding "Yes" to Question 11. On the bar graph figures presented in this section this group will be referred to as "Y" (see Table V).

From the results of the questionnaires received from this group it can be implied that they are not satisfied with Navy contract administration. Their opinion of the regard that Navy personnel have for inspection is divided between the upper three categories as shown in Figure 75. This indicates that they have had both good and bad experiences with Navy construction representatives. They do not feel that the Navy personnel have used inspection to get work that is not clearly shown in the plans and specifications. It can be seen in Figures 77 and 78 that they feel that ROICC personnel only "sometimes" have understood and had a good regard for CQC. It can be concluded from Figure 79 that occasionally CQC jobs have been inspected too much, but more importantly, there is no uniformity in their response. Again this indicates that CQC contracts have not been administered with consistency. There is an implied level of friction from some of these responses with the Navy. This certainly would affect the success of a CQC contract.

In Figure 80 it can be seen that this group of contractors feel that good CQC representatives are always difficult to find. The CQC representative can create unsatisfactory conditions on the job if he is unqualified. If this creates dissatisfaction on the part of the ROICC, the representative may be removed. This places a demand on the contractor to find a new man. It can be concluded from Figures 81 thru 86 that this group has a lower opinion of the benefits and mechanics of CQC than the contractors who indicated that they want to retain the CQC provision in their contract. The results illustrated in Figures 82 and 83 show that CQC often gets the job off to a smoother start and gives the contractor more

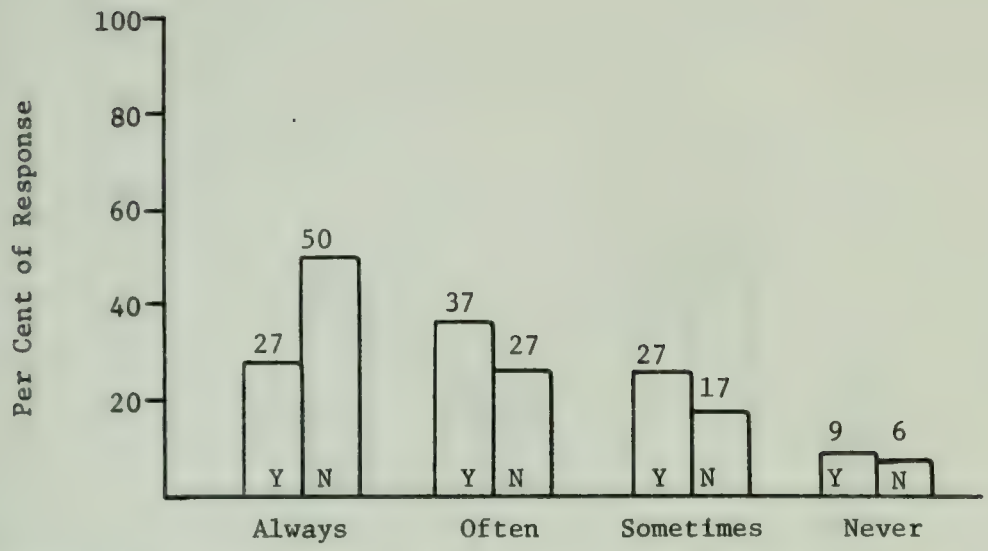


Figure 75 Responses from CQC Contractors to Question 3a. Do you feel that the Navy ROICC offices that you have worked with on CQC jobs have had a good regard for inspection?

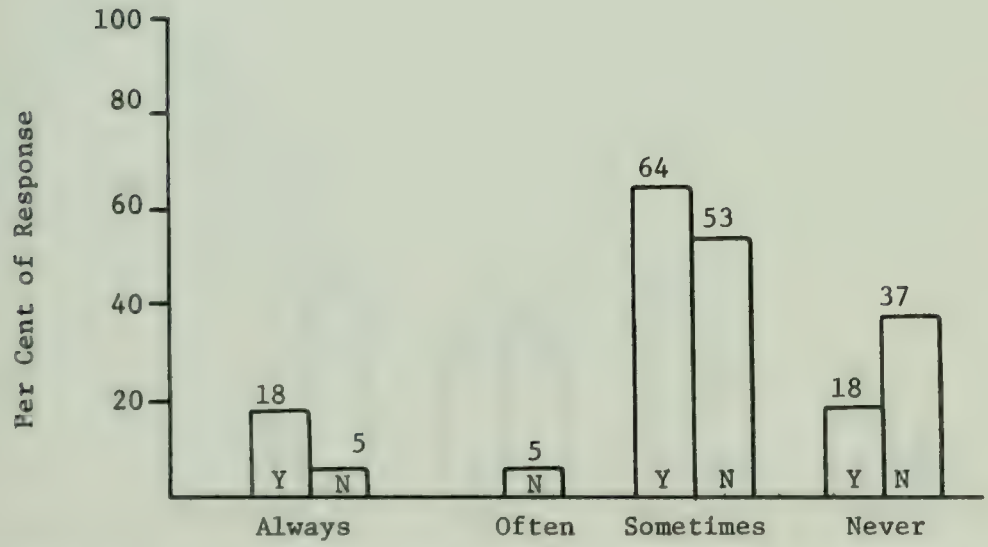


Figure 76 Responses from CQC Contractors to Question 3b. Do you feel that the Navy ROICC offices that you have worked with on CQC jobs have used inspection to get work that is not clearly shown in the Plans and Specifications?

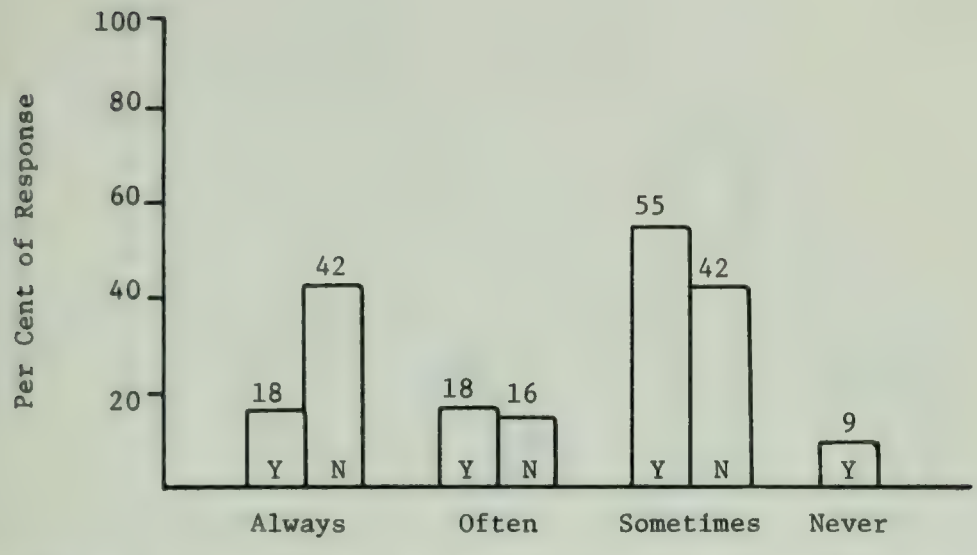


Figure 77 Responses from CQC Contractors to Question 8a. In considering past CQC contracts, do you think that Navy personnel have understood CQC?

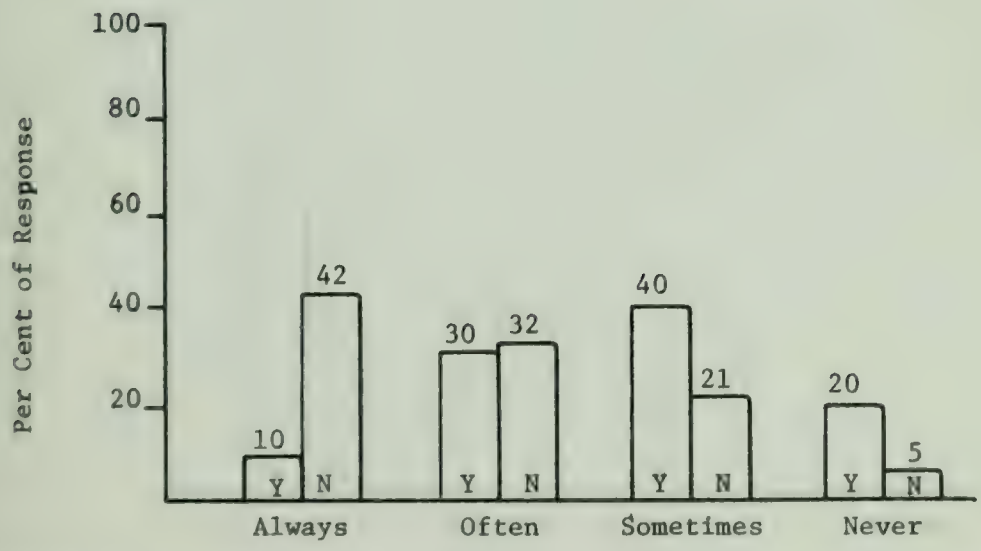


Figure 78 Responses from CQC Contractors to Question 3f. Do you feel that the Navy ROICC offices that you have worked with on CQC jobs have had a good regard for the CQC program?

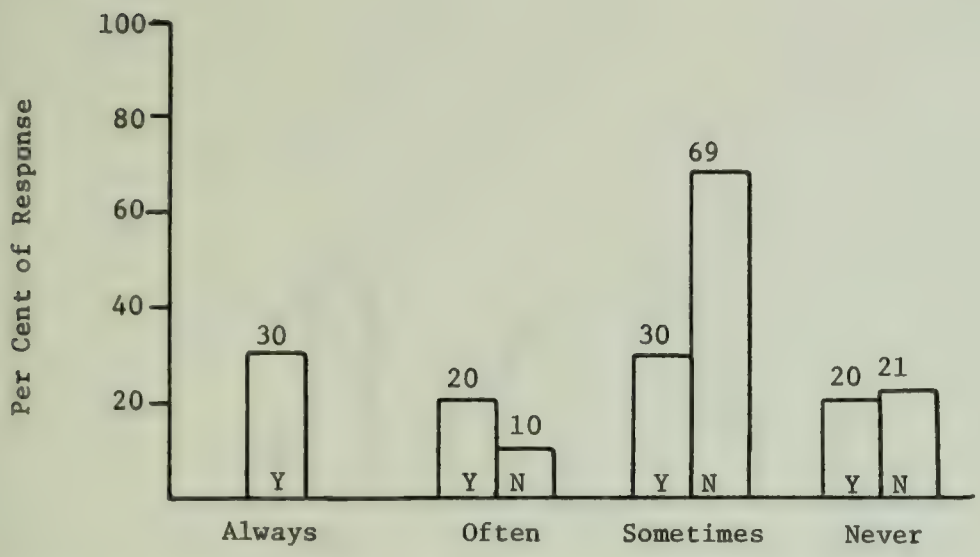


Figure 79 Responses from CQC Contractors to Question 8c. In considering past CQC contracts, do you think that the Navy overinspects its CQC jobs?

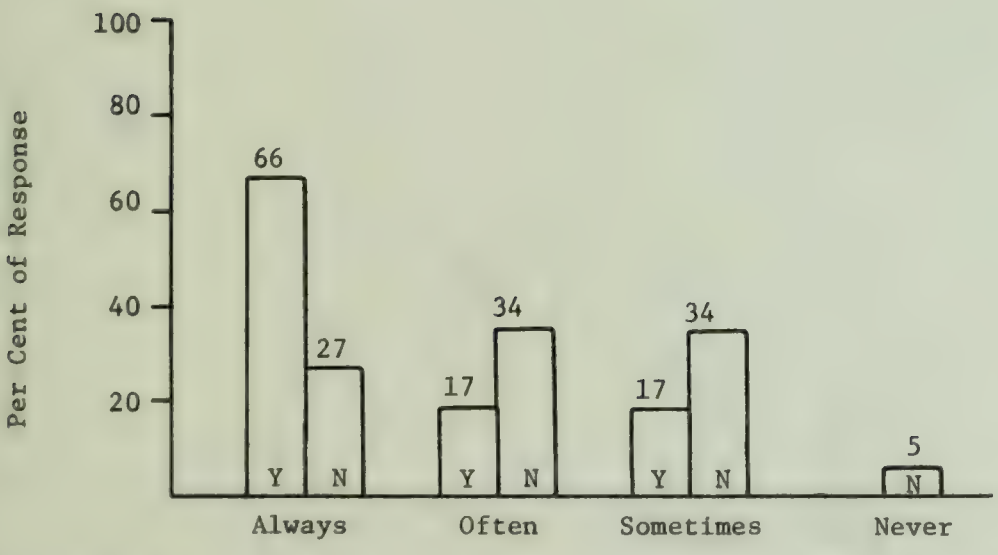


Figure 80 Responses from CQC Contractors to Question 4f. Do you feel that good CQC representatives are difficult to find?

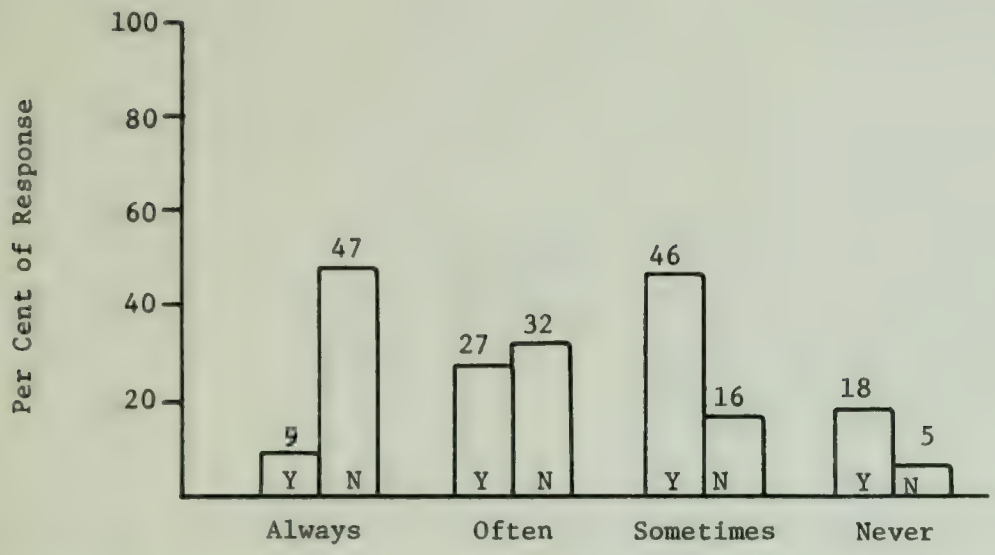


Figure 81 Responses from CQC Contractors to Question 4h. Do you feel that CQC reduces submittal approval time?

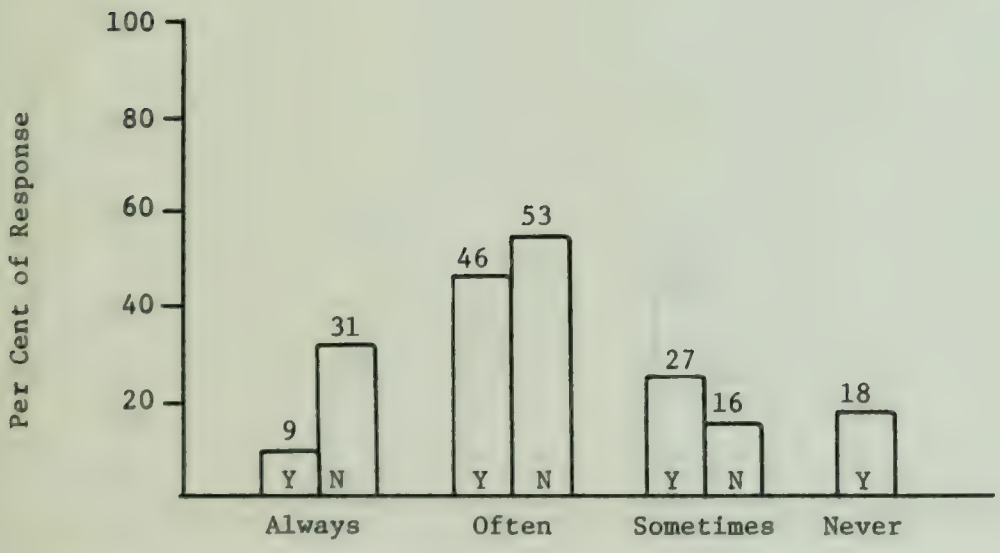


Figure 82 Responses from CQC Contractors to Question 4i. Do you feel that CQC gets the job off to a smoother start?

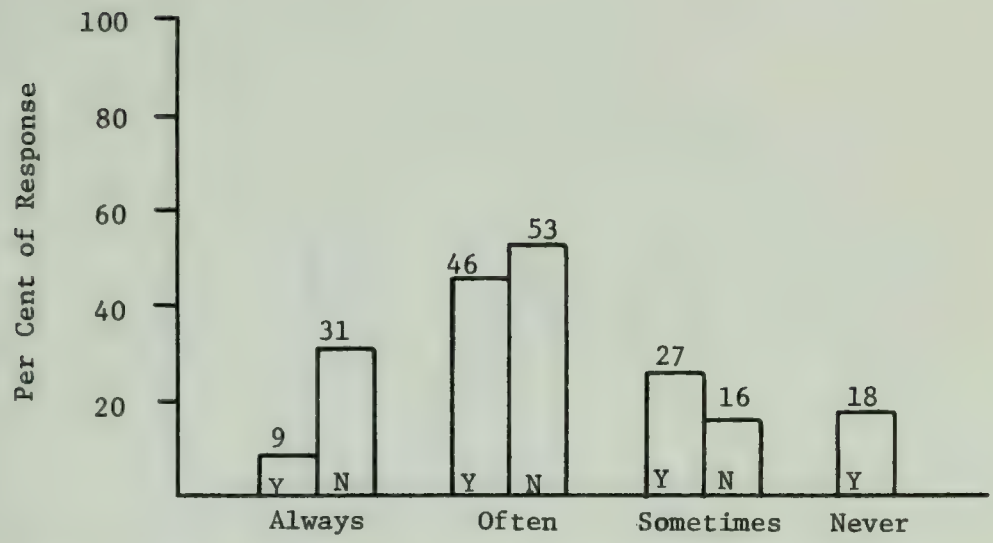


Figure 83 CQC Contractor Responses to Question 4j. Do you feel that CQC gives you more freedom in controlling your own operations?

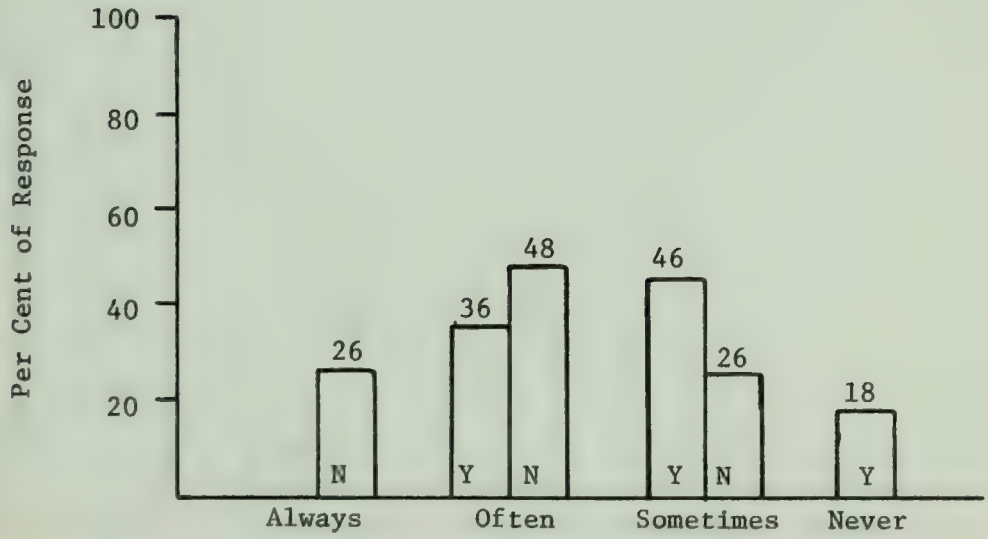


Figure 84 CQC Contractor Responses to Question 4k. Do you feel that CQC helps you to recognize construction problems and solutions earlier?

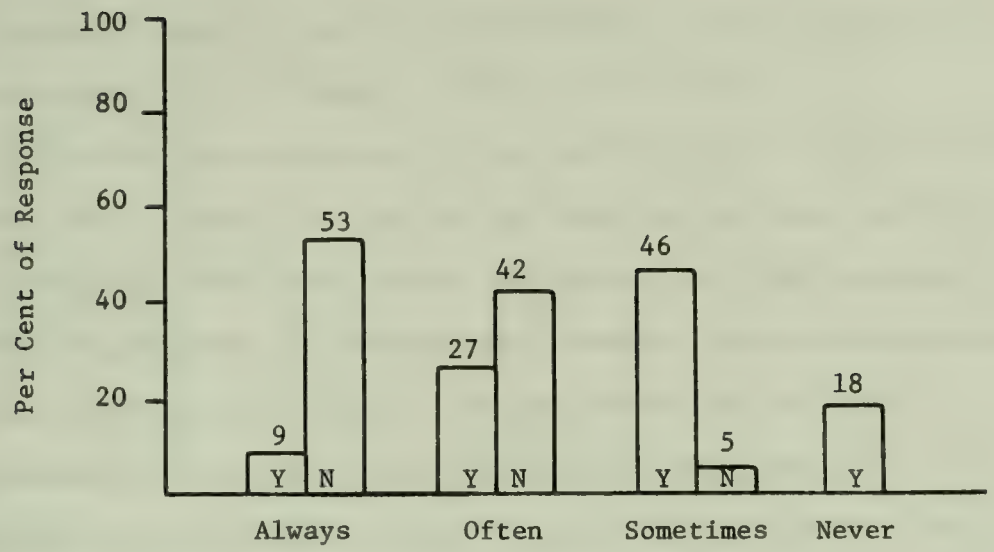


Figure 85 Responses from CQC Contractors to Question 8d. In considering past CQC contracts, do you think that the CQC plan is a valuable asset to your inspection program?

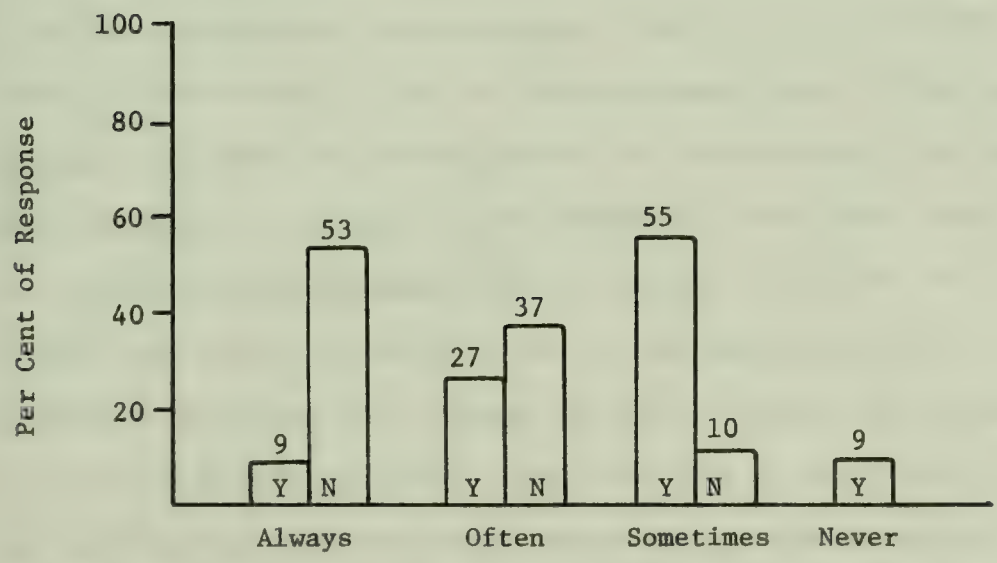


Figure 86 Responses from CQC Contractors to Question 8e. In considering past CQC contracts, do you think that the three stage inspection operation (preparatory, initial, follow-up) gives you a satisfactory inspection program?

freedom in controlling his own operations. These benefits are important to the ultimate success of the project.

The CQC requirements are often satisfactory as shown in Figure 88, but in Figure 87 it can be seen that most of these contractors always want more specificity in the selection of CQC personnel. The CQC personnel requirements are normally vague which allows the contractor to determine just how much inspection he feels is necessary. In a competitive bid situation the costs for a CQC program may be flexible enough to cause the contractor to lose the award. This can be a serious problem if the administration of CQC contracts varies from ROICC to ROICC and EFD to EFD. Their response to the question concerning the cost of CQC is illustrated in Figure 89. According to this group CQC is "often" too expensive to provide which reinforces the discussion about the uncertainty of CQC in a competitive bid situation. They indicated that CQC normally costs about 2.7% of the contract award price, a full percentage point above the value given by the other group. They feel that contractor responsibility for inspection often lends itself to a construction management form of contract. It can be concluded from these responses that one of the reasons that Navy inspection is preferred is because CQC costs too much and creates an uncertain bidding situation due to the lack of specificity in the contract documents about the numbers and qualifications of required personnel. A negotiated contract such as CM appeals to these respondents.

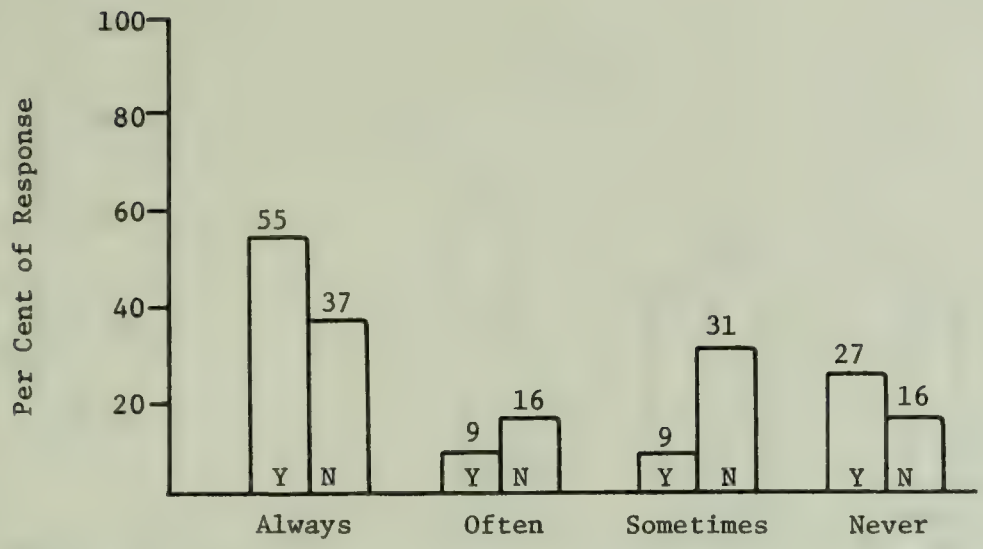


Figure 87 Responses from CQC Contractors to Question 8f. In considering past CQC contracts, do you think that the Navy should specify the number and qualifications of CQC personnel in the contract?

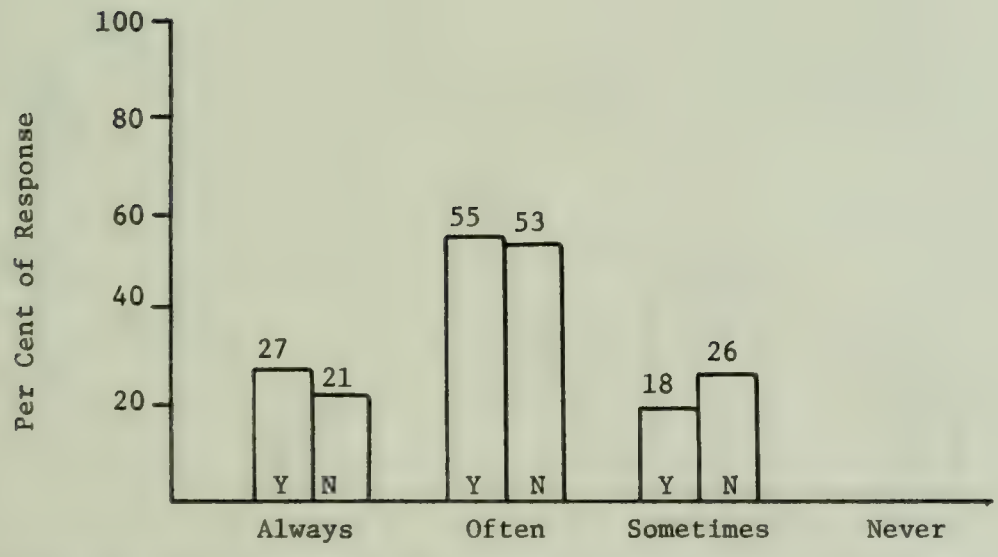


Figure 88 Responses from CQC Contractors to Question 8g. In considering past CQC contracts, do you think that the CQC requirements in the various divisions of the contract give you enough information to plan a good CQC program?

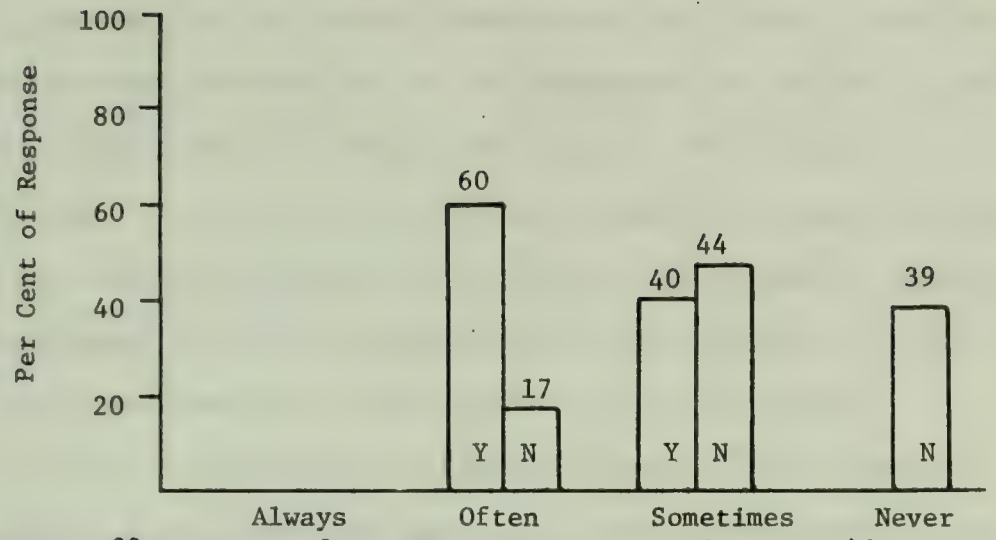


Figure 89 Responses from CQC Contractors to Question 4d. Do you feel that the cost of a "satisfactory" CQC program is too expensive to provide?

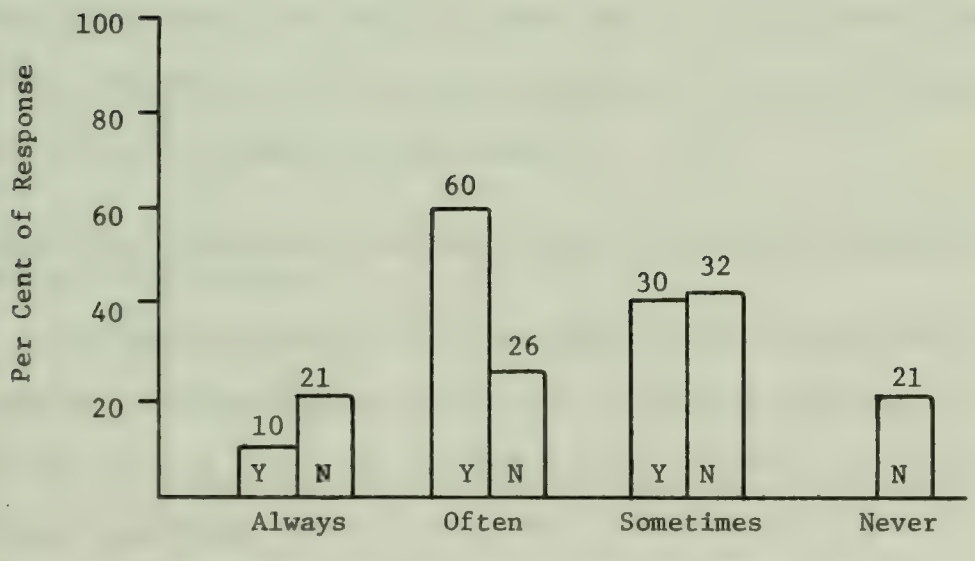


Figure 90 Responses from CQC Contractors to Question 4n. Do you feel that contractor responsibility for inspection lends itself to a Construction Management type of contract?

According to the results presented in Table XXIII, these contractors want the Navy to have the responsibility for the inspection in all cases except, perhaps, job progress. This inspection is important to the contractor because it represents payment and gradual acceptance or rejection of the work. Quality control inspection was thought to be the responsibility of the contractor in only thirty seven percent of the responses (see Table XXIII).

It can be concluded from Figures 91 thru 93 that these contractors do not feel that there is a conflict of interest or that there is a problem with the CQC representatives working for them. Only "sometimes" does CQC give the Navy a better completed job than under NCIS. The success of CQC in nongovernment work is rated as "sometimes" (see Figure 94). The contractors who want to retain the CQC in the contract are much more positive than this group. These respondents have indicated that CQC is unsatisfactory because of the uncertainty of the program relating to the cost of bidding and in administering such a program.

Section 6b. Contractors Who Want to Retain the CQC Provisions as Part of Their Contract

The nineteen contractors in this group have responded "No" to Question 11 indicating that they want to continue to do work in the CQC program. They will be referred to as "N" on the bar graph figures (see Table V).

In contrast to the other group of CQC contractors, these respondents have indicated that they like CQC. These contractors feel that ROICC personnel have had a good regard for inspection (see Figure 75) and that they have not used it to get work that is

Table XXIII

Responses from CQC Contractors to Question 2 According to Question 11 Replies. Responsibility for Inspection and Quality Control[1]

	Interpretation of the Plans and Specifications		Quality Control Inspection		Job Progress Inspection		Final Acceptance of each stage of the work	
	Delete CQC (2)	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC
Navy	35	8	42	5	33	5	56	22
Contractor	8	10	21	58	21	30	-	22
Shared: Navy Contractor/ Designer Architect/Engineer	22	62	16	25	25	50	20	42
Shared: Navy/ Design Architect/Engineer	-	10	-	-	-	7.5	4	8
Design Architect/Engineer	35	10	21	12	21	7.5	20	6
Total No. Responses	23	29	24	40	24	40	25	36

Note:

1. The values in this table are expressed as a percentage of the Total No. of Responses.
2. For an explanation of "Delete CQC" and "Retain CQC" see Table V.

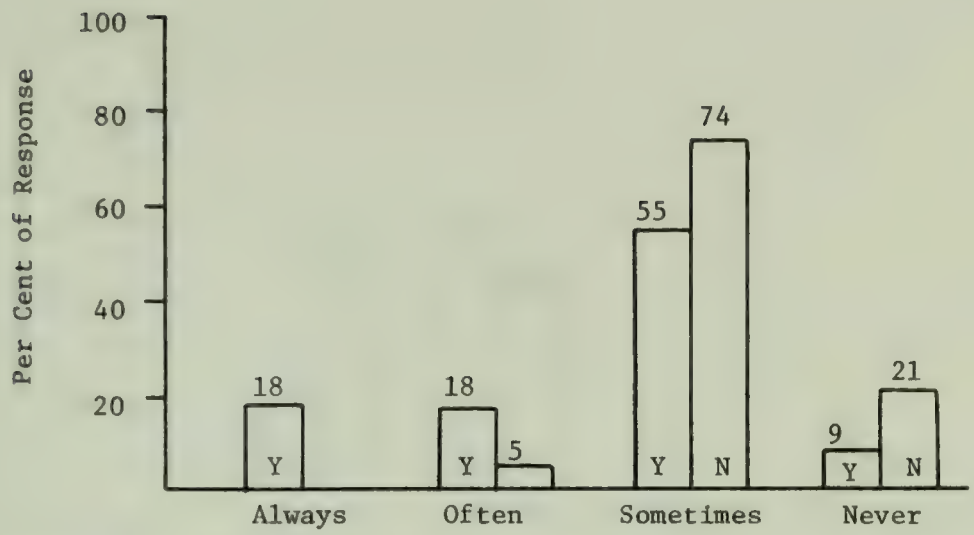


Figure 91 CQC Contractor Responses to Question 4m. Do you feel that there is a conflict of interest because you are inspecting your own work?

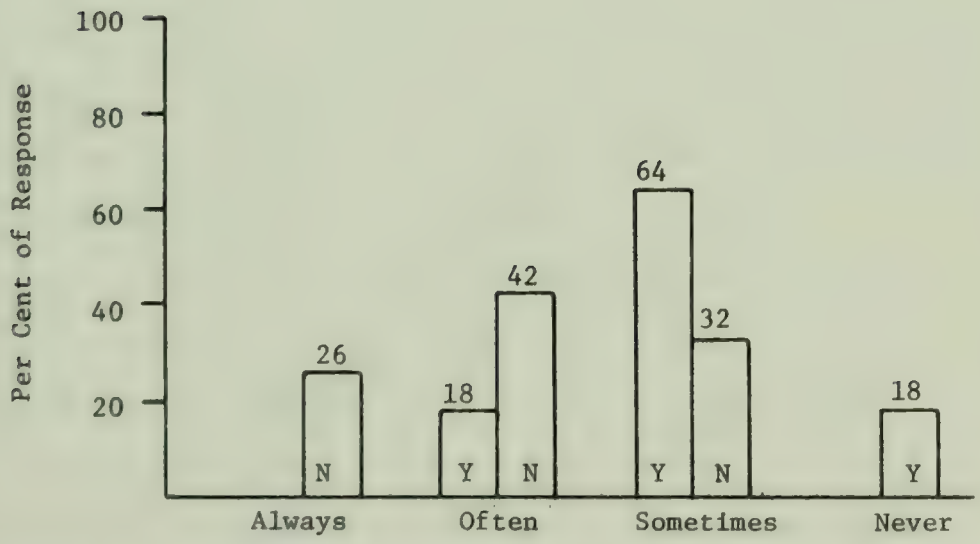


Figure 92 CQC Contractor Responses to Question 41. Do you feel that inspection by your own forces gives the Navy a better completed job than under the old Navy Construction Inspection System?

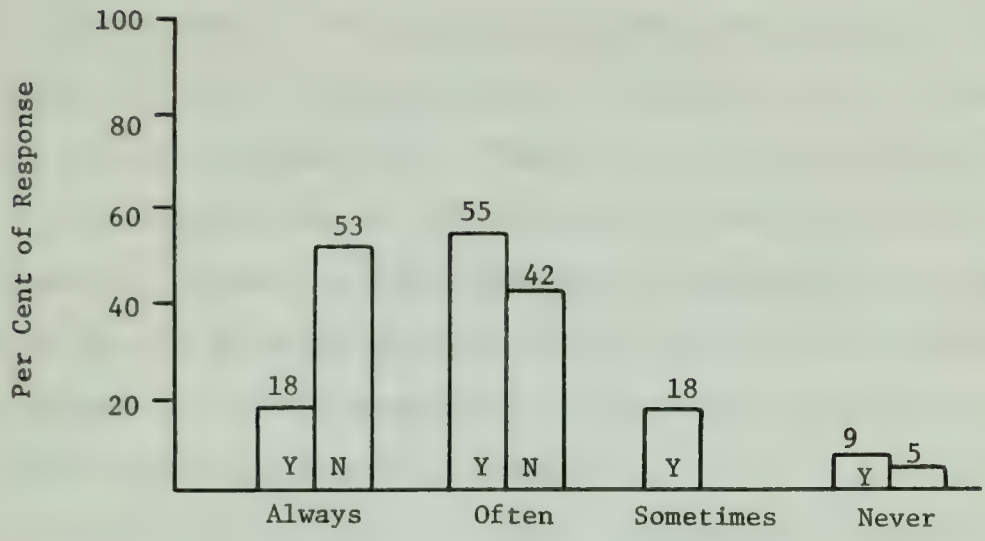


Figure 93 CQC Contractor Responses to Question 8a. In considering past CQC contracts, do you think that the CQC Representative can be on the contractor's payroll and properly inspect the work?

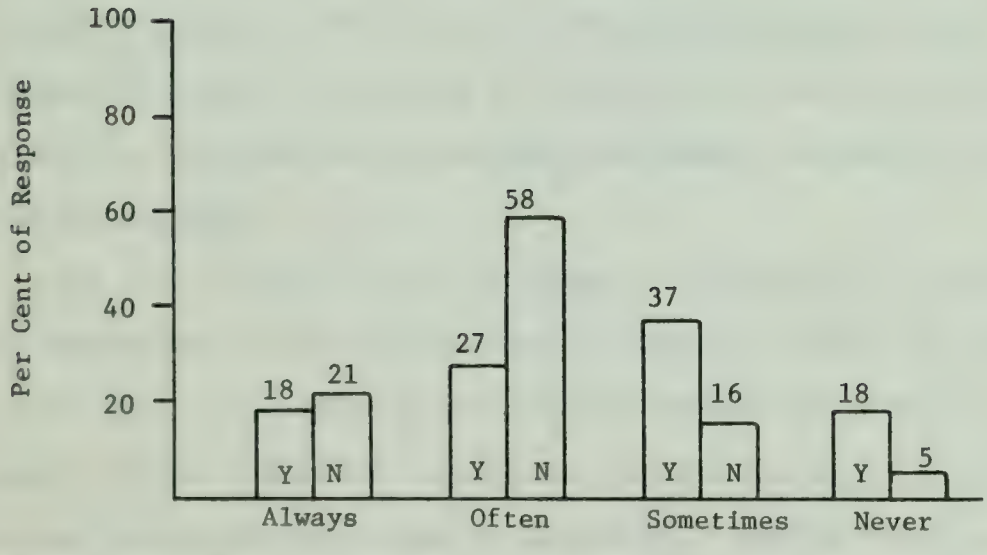


Figure 94 CQC Contractor Responses to Question 8h. In considering past CQC contracts, do you think that a program like CQC could be successful on non-government jobs?

not clearly shown in the plans and specifications (see Figure 76). In contrast, they are indecisive about the Navy personnel's regard for and understanding of CQC. These responses imply that CQC is not only misunderstood, it is both liked and disliked by Navy personnel. Unlike the other group, these contractors feel that CQC jobs are only sometimes overinspected (see Figure 79). It can be concluded from these statements that this group has had both good and bad experiences with ROICC offices.

They do not have as much difficulty finding CQC personnel as the other CQC contractors, but it is "often" a problem as shown in Figure 83. It can be concluded from Figures 81 thru 86 that the contractors who want to retain the CQC provisions as part of their contracts are very favorably inclined towards this program. Of particular interest is the benefit they see in reduced delays from submittal approval. They like the CQC plan and the three stage inspection program. In Figure 87 it can be seen that they are divided on the question of specifying the number and qualifications for CQC personnel.

The cost of CQC is often too expensive although this response is considerably lower than that made by the other group. It would appear that the benefits of CQC outweigh the cost drawbacks. It can be seen in Table XXIII that these respondents want to take an active role in all four areas of inspection. They feel that the contractor should have the sole responsibility for quality control. This was one of the goals of the CQC program; the majority of the contractors in this study have implied that they concur.

The contractors in this group feel that "sometimes" there is a conflict of interest with CQC, but they have indicated that the CQC representative can often be on the contractor's payroll and properly inspect the work as shown in Figures 91 and 93. It can be seen in Figure 92 that CQC often gives the Navy better completed work. These results are much more favorable than those made by the other group. It would be expected that they would feel that CQC "often" could be used on nongovernment construction (see Figure 94). They are divided on the subject of construction management. This can be seen in Figure 90.

It can be concluded from the data presented in this section that the contractors who want to keep the CQC provisions in their contracts like CQC because it gives them more control of their operations and it saves them time. The advantages of CQC to these contractors override the costs to the owner for providing such a program. The Navy often receives better work because of CQC. These favorable responses have been reflected in their attitude that it can work on nongovernment projects.

Section 7. Analysis of Similar Questions Asked of Architect/Engineers, Contractors, CQC Contractors, and Navy Personnel

The similar questions asked of the architect/engineers, contractors, CQC contractors, and Navy personnel will be discussed in this section. The bar graph notations are shown in Table VI. A table of similar questions to facilitate finding the data in other appendices can be found in Appendix O. The opinions of the respondents concerning inspection, costs, and responsibility will be discussed in this section.

Although the Navy and the architect/engineers are grouped together for discussion, they actually are the owner and the representative of the owner respectively. They both perform the inspection function and therefore will be compared on that basis. It is interesting to note that these two groups are remarkably similar in the distribution of many of their responses. It can be seen in Figure 95 that the designers and Navy personnel (contract administrators) usually have had a good regard for inspection. Both groups of contractors have indicated their feeling that that regard is lower. The non-CQC contractors have responded the most conservatively which means that there are some designers who have not shown a good regard for inspection. All of the respondents feel that contract administrators sometimes use inspection to get work that is not clearly shown in the plans and specifications (see Figure 96). Again the non-CQC contractors feel that this happens more often than the other three groups. An explanation for this may be that the Navy personnel are probably more consistent in their dealings with contractors. Another facet is that the Navy construction representatives often have similar backgrounds.

The respondents were asked to evaluate contractors in general and to state their opinion as to what level of quality they normally provide. The results of this question have been reproduced in Table XXIV. The contract administrators and the contractors are on either extreme. The low regard that the Navy respondents have indicated can be seen again in this table. The unfavorable responses that were received concerning the typical level of quality that contractors provide in the lower two categories by most of the

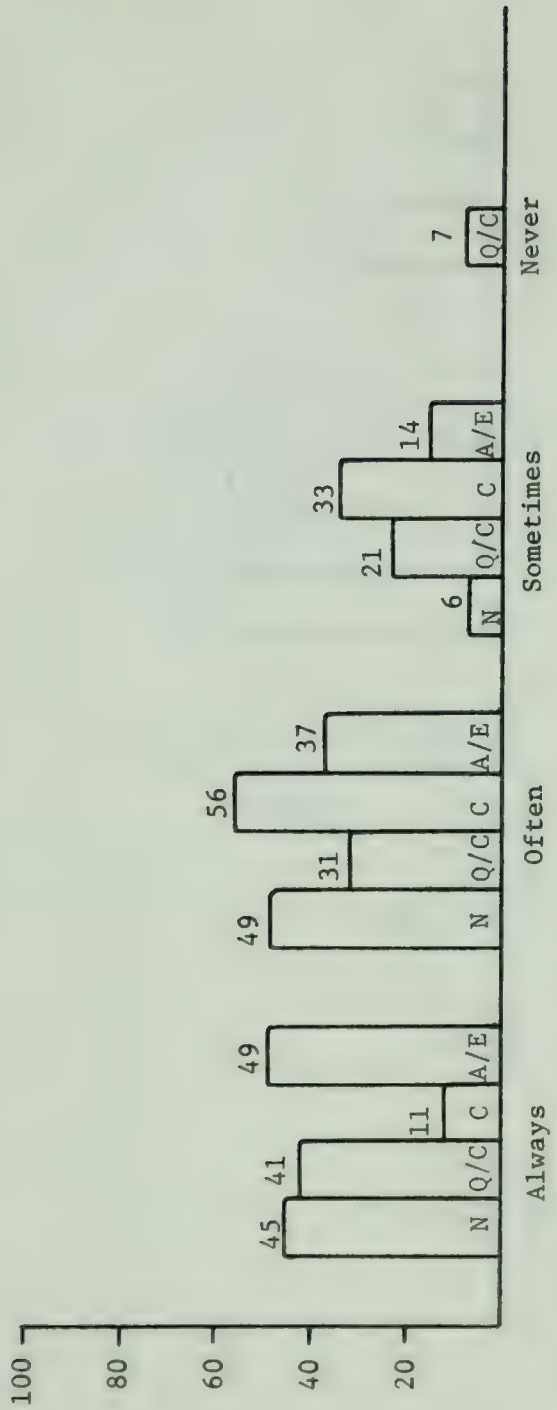


Figure 95 Responses from Civilian and Navy Related Respondents to Question 3a. Do you feel that the Designers/Navy ROICC personnel that you have worked with have had a good regard for inspection?

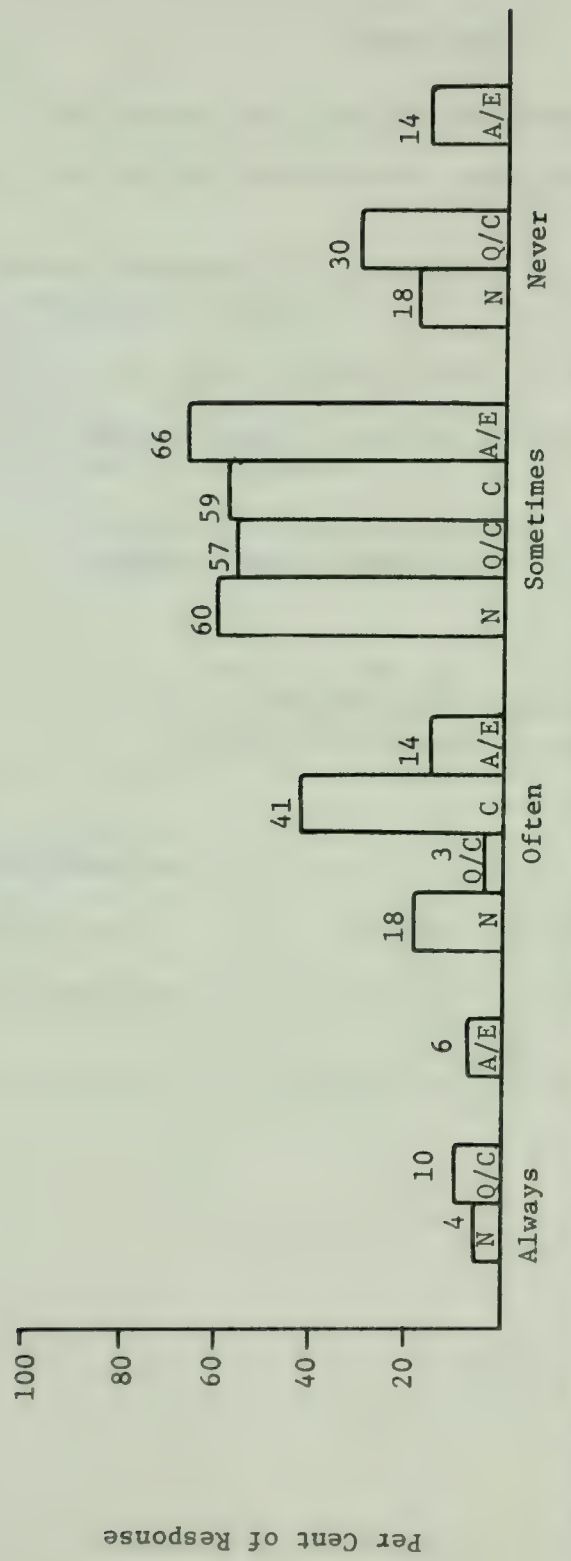


Figure 96 Responses from Civilian and Navy Related Respondents to Question 3b. Do you feel that the Designers/Navy ROICC personnel that you have worked with have used inspection to get work that is not clearly shown in the Plans and Specifications?

Table XXIV

Navy Related and Civilian Responses to Question 5.

(Note: On the A/E Questionnaire question 5 corresponds with 7.)

To your knowledge, do contractors in the following categories have a tendency to provide:

a. Just enough quality control to get by?

b. Level of quality control that is required by the Plans and Specification?

c. Level of quality control that is higher than (b) to enhance company reputation?

	Up to $100,000 per award	Up to $500,000 per award	Up to $1Million per award	Up to $3Million per award	Unlimited per award
Navy	a	a	a(c:5%)	b(c:11%)	b(c:25%)
Architect/Engineer	a	a	b	b(c:18%)	b(c:21%)
CQC Contractor	a	a(c:5%)	b(c:6%)	b(c:39%)	b(c:33%)
non-CQC Contractor	a	b(c:11%)	b(c:35%)	b(c:35%)	b(c:41%)

groups must be considered along with the fact that only three contractors out of fifty seven had an annual award volume of less than $1 million.

All of the respondents believed that the contractor always should be responsible for the quality of his work. The lower response in the always category made by the non-CQC contractors is shown in Figure 97. The level of quality that the Navy specifies is probably more uniform than that made by the designers in non-government work. Standard specifications are used which often helps the contractor who has had previous Navy contracting experience to know what to expect during construction. Another consideration is that the Navy projects may be different. For these reasons the CQC contractor may be more inclined to respond so highly in the always category.

All four groups have indicated that inspection is a service that they always like to have on their work. Both groups of contractors have lower responses in the always category on this question. This can be seen in Figure 98. The Navy, designer and CQC contractor respondents feel that inspection always ensures quality, while all four groups feel that it helps find mistakes (see Figures 99 and 100). The three stage inspection system may have prompted the CQC contractors to respond more heavily in the always category because it is intended to find and correct mistakes earlier. The non-CQC Contractors have mixed feelings about the effectiveness of inspection ensuring quality. This could be attributed to different definitions of inspection by the two groups of contractors. This also may be because the part-time inspection that many jobs have is

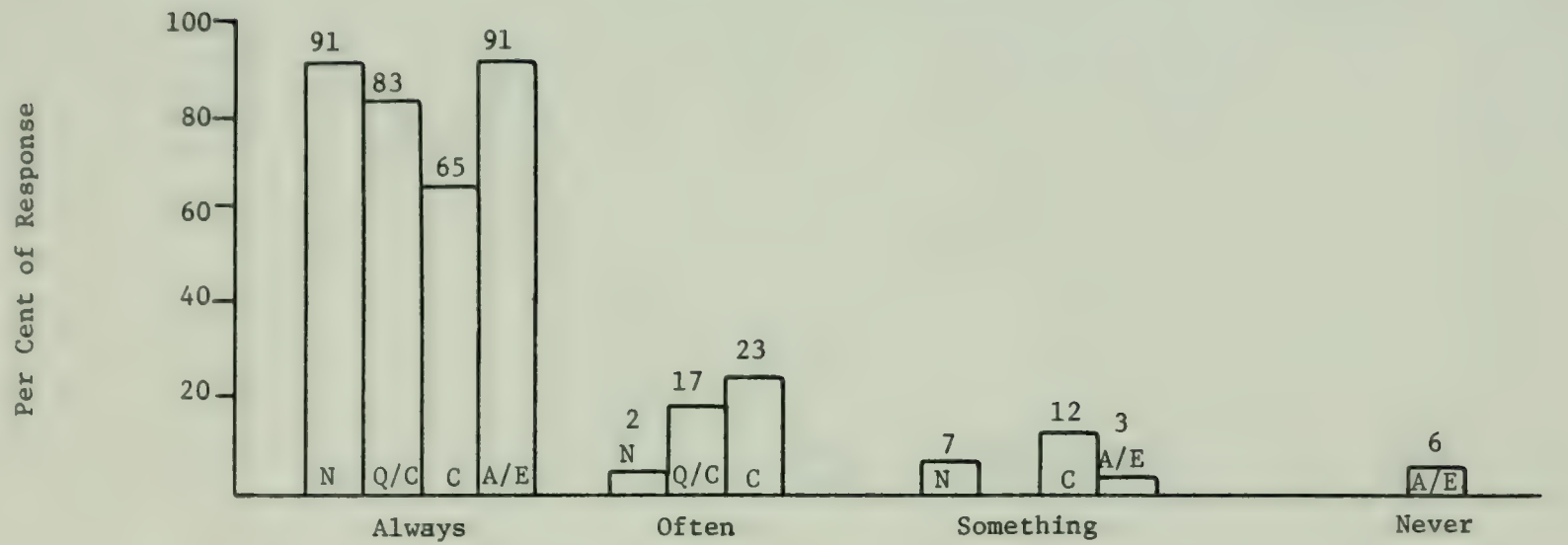
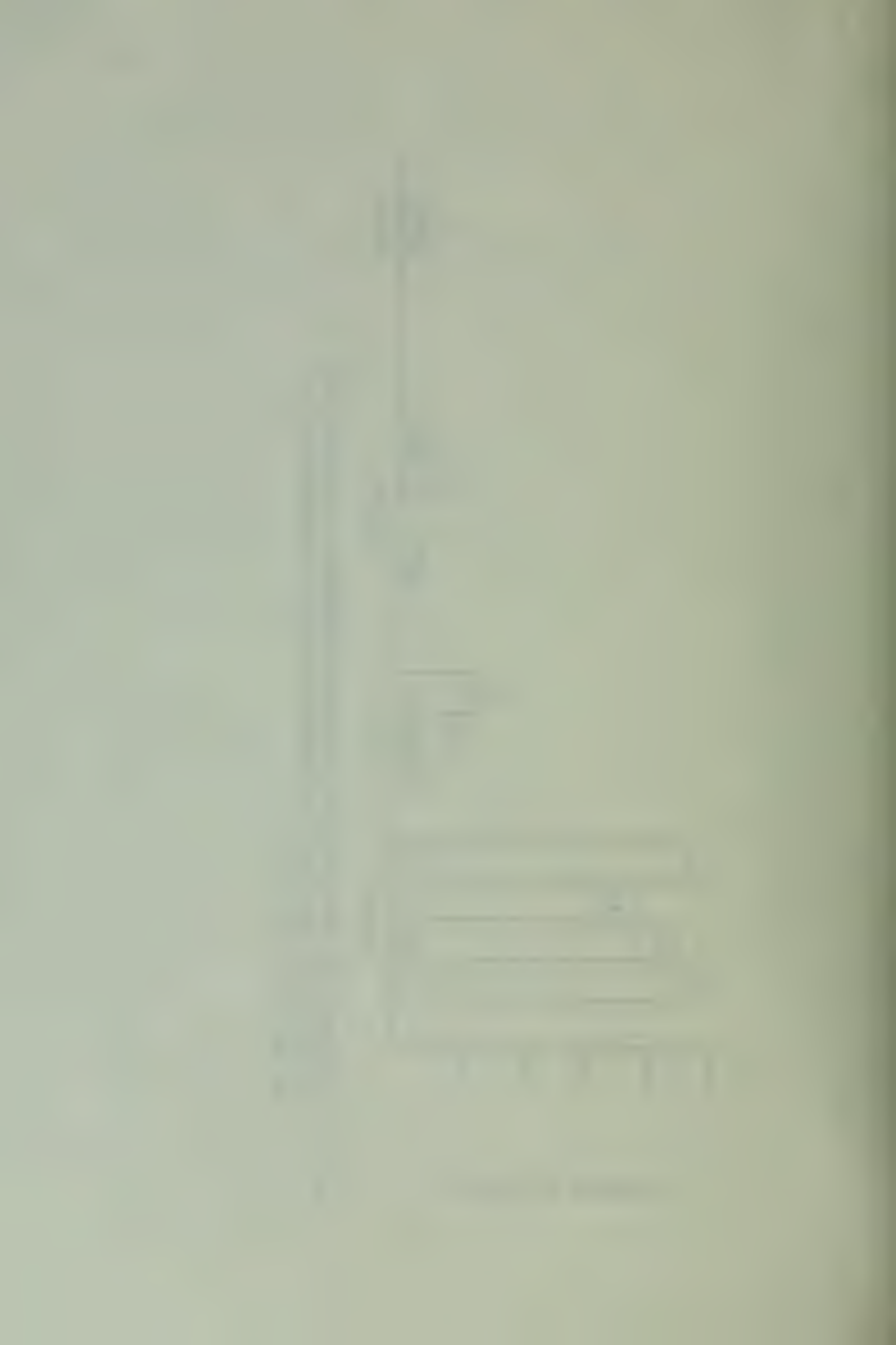


Figure 97 Responses from Civilian and Navy Related Respondents to Question 10g/ 10f/4e. Do you feel that the contractor should be responsible for the quality of his job?



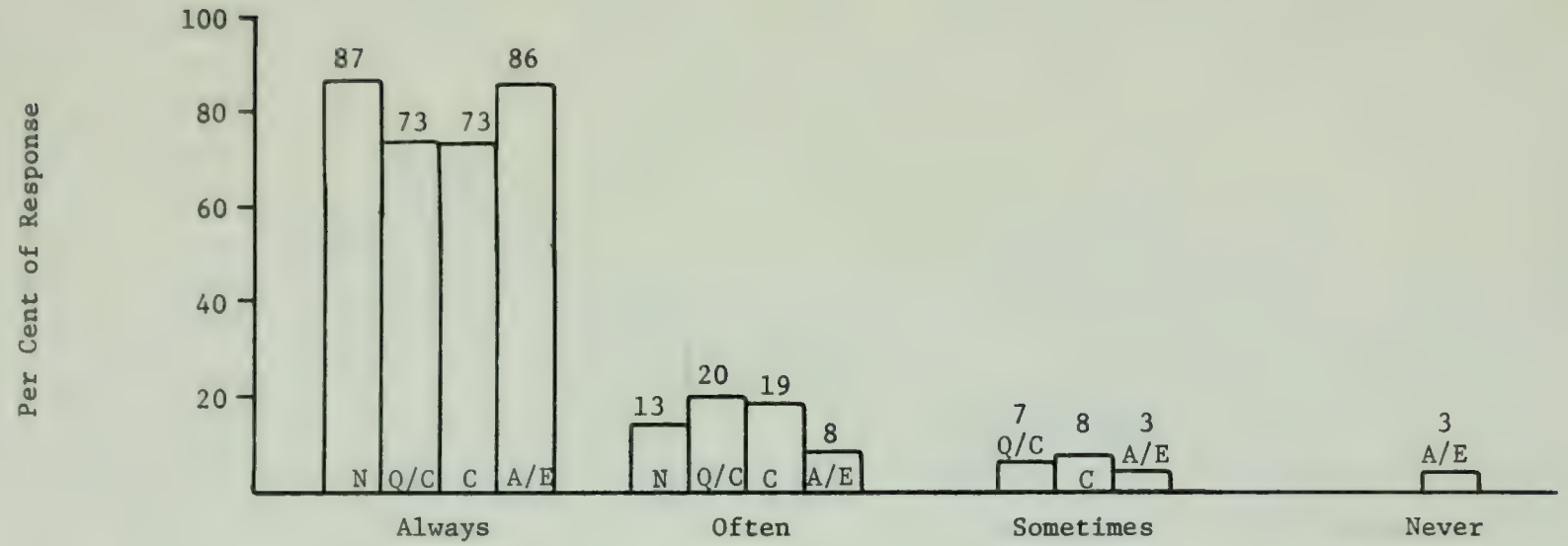


Figure 98 Responses from Civilian and Navy Related Respondents to Question 4b(v)/4d/4c. Do you feel that inspection is a service that you like to have on your job?

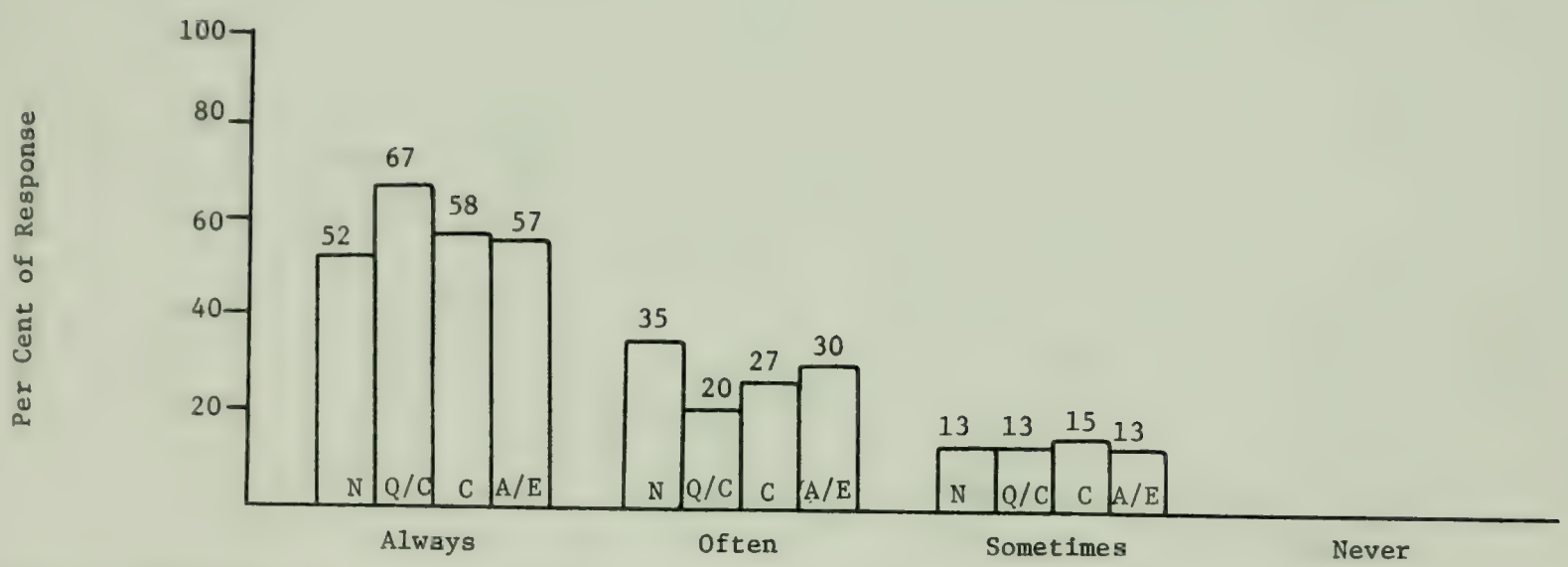


Figure 99 Responses from Civilian and Navy Related Respondents to Question 4b(iii)/4c/4b. Do you feel that inspection is a good tool to help even the best of contractors find mistakes?

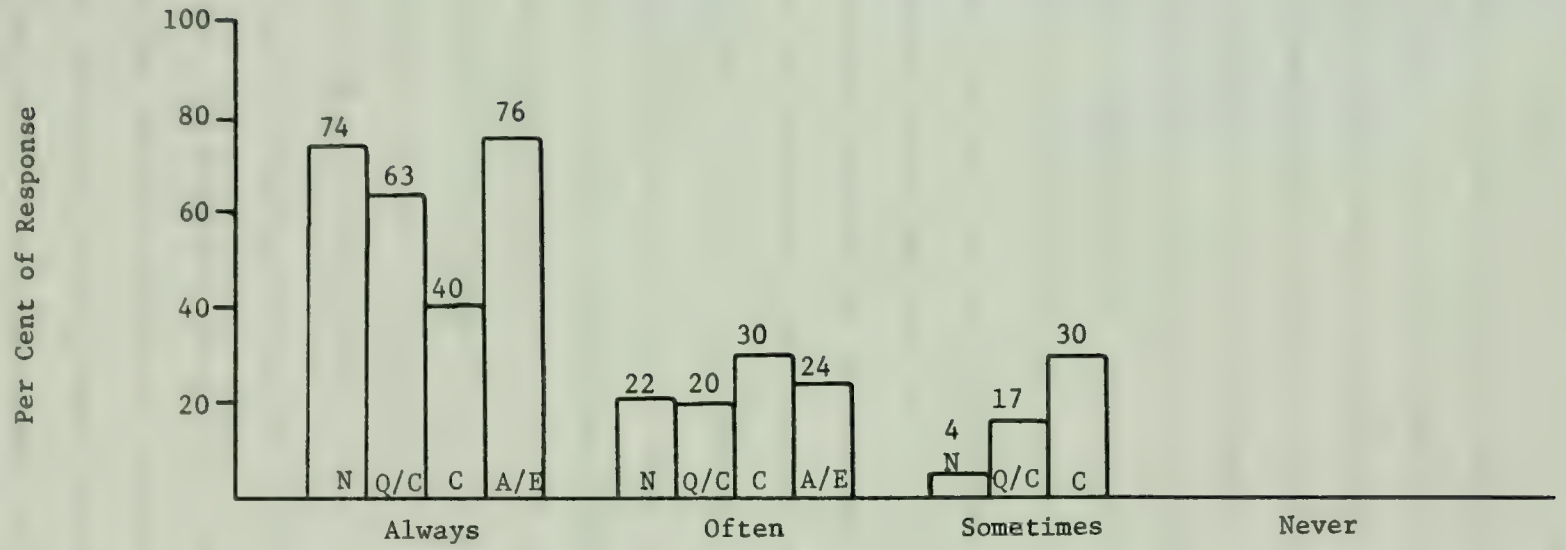


Figure 100 Responses from Civilian and Navy Related Respondents to Question 4b(ii)/4b/4a. Do you feel that inspection is a good tool to ensure that the contractor provides the level of quality specified in the contract?

not as effective as fulltime inspection for ensuring quality. This response is consistent with the non-CQC contractor's feeling that designers only often have a good regard for inspection (see Figure 95). It can be concluded from Figures 98 thru 100 that inspection is a well accepted method of helping both the contractor and the contract administrator provide the owner with the quality that has been specified in the contract documents.

It can be seen in Table XIX that the Navy personnel and CQC contractors believe that the contractor performing work on government contracts should participate in the inspection function. The designers feel that the architect/engineer and/or his representatives should inspect the work (see Table VIII). Twenty percent of the contractor responses in the five contract ranges were made in favor of the contractor's participation in the inspection function. The Navy personnel's exposure to CQC was probably the reason for the high percentages in favor of contractor participation (see Table XXV). In contrast 38% of the designers have had previous experience with CQC and only one half of one percent of the total responses made by the designers were in the category for sharing the responsibility with the contractor.

It can be seen in Table XXVI that forty eight percent of the respondents have indicated that they want CQC provisions in their contracts. The designers like CQC the least, but the CQC contractors and representatives want to continue to participate in this program. Contractor quality control may represent a loss of control to the designers. On the other hand, the CQC contractors have indicated that they like the benefits of the program. The contract

Table XXV

Civilian and Navy Related Respondents Who have had CQC Experience

Respondent Category	No. of Responses	Per Cent of Response
Architect/Engineer	14	38
Contractor	23	85
Navy Personnel	54	100
CQC Contractor	30	100
CQC Representative	12	100

Table XXVI

Civilian and Navy Related Respondents Who Want CQC Provisions in Their Contracts

Respondent Category	No. of Responses	Per Cent of Response
Architect/Engineer	10	27
Contractor	12	44
Navy Personnel	26	48
CQC Contractor	19	63
CQC Representative	10	83
Total	77	48

administrators believe that CQC often represents a conflict of interest while the contractors have indicated that this problem will exist only "sometimes" (see Figure 101). The designers feel that the contractor "never" can have the sole responsibility for the inspection and do a better job of it (see Figure 102). The Navy personnel feel that sometimes CQC gives the government better completed jobs. It can be concluded from these two figures that the Navy personnel, since they have worked with CQC, are more in favor of shared responsibility for the inspection. The designers and the non-CQC contractors were largely against the contractor having the sole responsibility for inspection. The CQC program does not give the sole responsibility to the contractor. Perhaps a program with shared responsibility would have appealed more to the designers.

It can be concluded from Figures 10 and 54 that all four groups are very close in their opinions of satisfactory inspection on contracts greater than $1 million. All of the respondents have indicated that highly disproportionate levels of inspection are required on contracts less than $1 million. It can be seen that inspection at these low levels is a very expensive consideration. All of the respondents indicated that inspection is either sometimes or never too expensive to provide. This can be seen in Figure 103. Both CQC and the typical inspection program involve about 2% of the contract value (see Table XXVII). These figures imply the cost of CQC would be competitive in the nongovernment construction market.

Figure 101 Responses from Civilian and Navy Related Respondents to Question 10e/10d/4m.
Civilian (10e/10d): Do you think that there would be a conflict of interest if the contractor inspected his own work?
Navy Related (4m): Do you feel that there is a conflict of interest because the contractor is inspecting his own work?

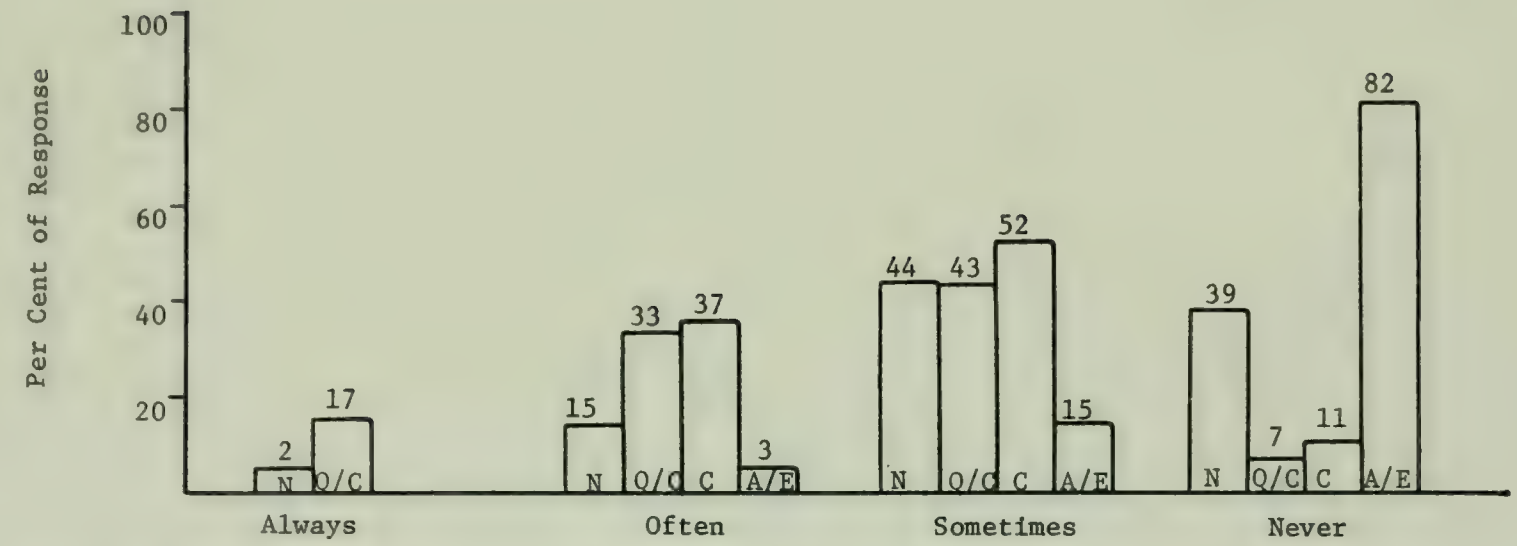
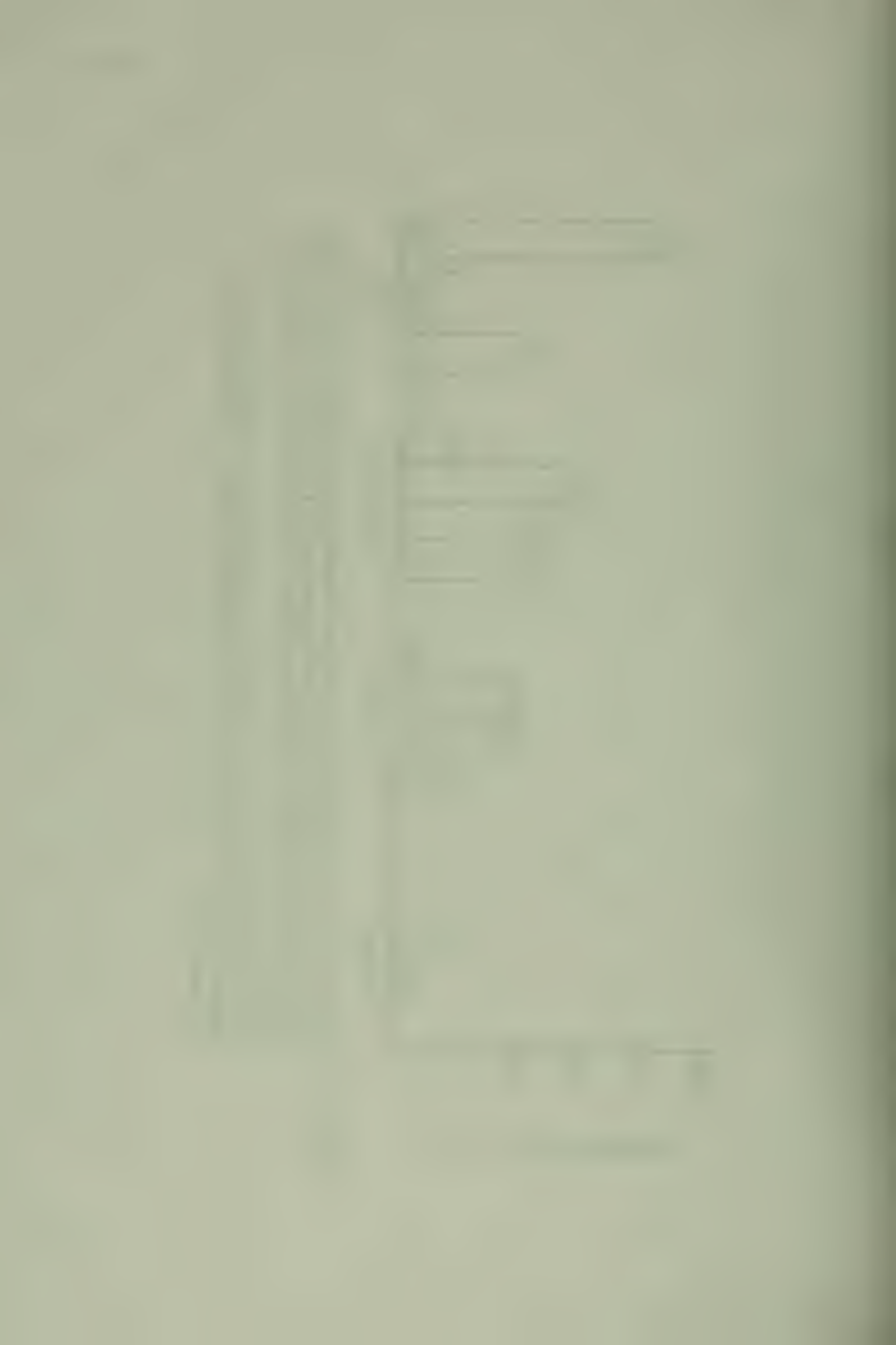


Figure 102 Responses from Civilian and Navy Related Respondents to Question 10d/10c/41.
Navy Related (41): Do you feel that inspection by the contractor gives the Navy a better completed job than under the old Navy Construction Inspection System?
Civilian (10c/10d): Do you think that the contractor can have the sole responsibility for the inspection and properly inspect a job better than the designer?



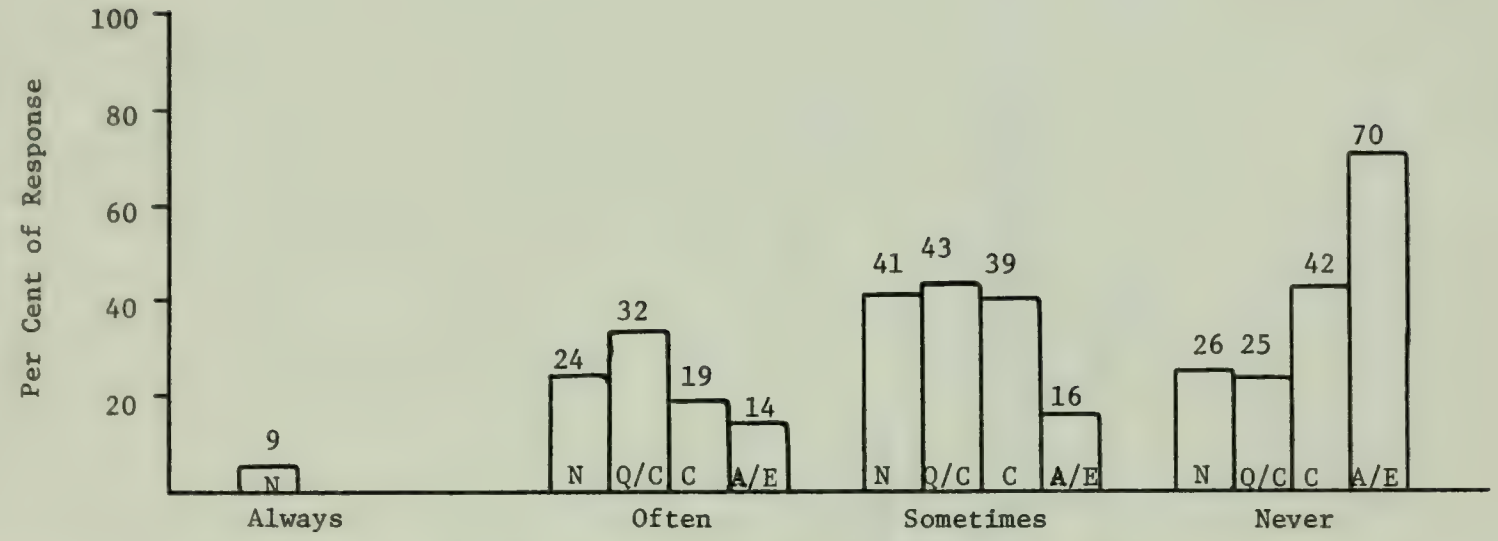


Figure 103 Responses from Civilian and Navy Related Respondents to Question 4b(iv)/4e/4d. Do you think that the cost of a "satisfactory" inspection/CQC program is too expensive to provide?

Table XXVII

Cost of Inspection and CQC as a Percentage of the Total Contract Award Price

	Per Cent of Total Contract Award Price
Architect/Engineer	2.2
CQC Contractor	2.1

The Navy related respondents have indicated that CQC often could be successful on non-Navy work which is shown in Figure 104. The non-CQC contractors and the architect/engineers have shown as a result of their responses which are shown in Table XXVI that CQC would not be widely accepted. Its limited use would probably be a feasible arrangement. Construction management is not necessarily the answer either (see Figure 105). Agreement between the contract administrators and the contractors over CQC is difficult. The use of CQC on nongovernment construction can be justified on those projects in which cooperation among the members of the building team can be expected.

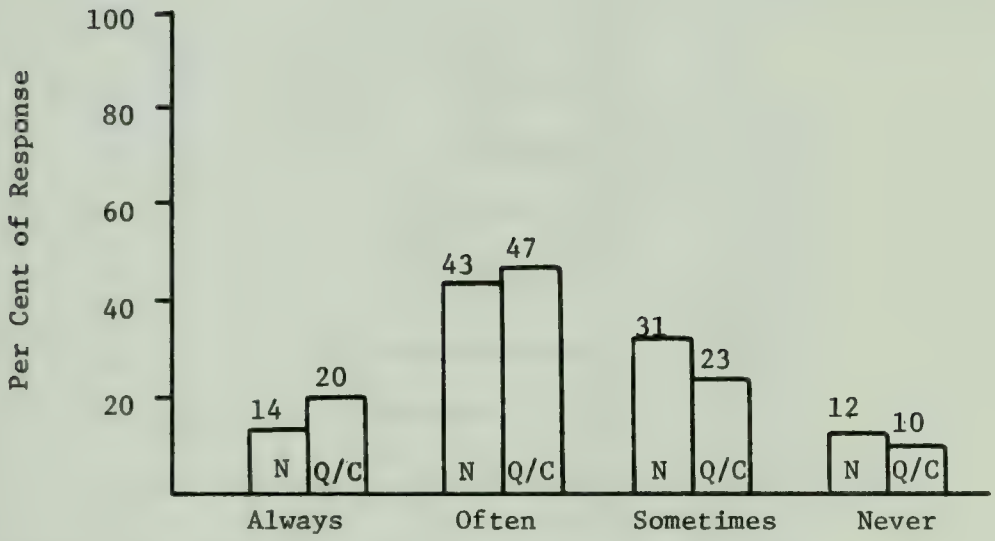


Figure 104 Responses from CQC Contractors and Navy Personnel to Question 8h. In considering past CQC contracts, do you think that a program like CQC could be successful on non-government jobs?

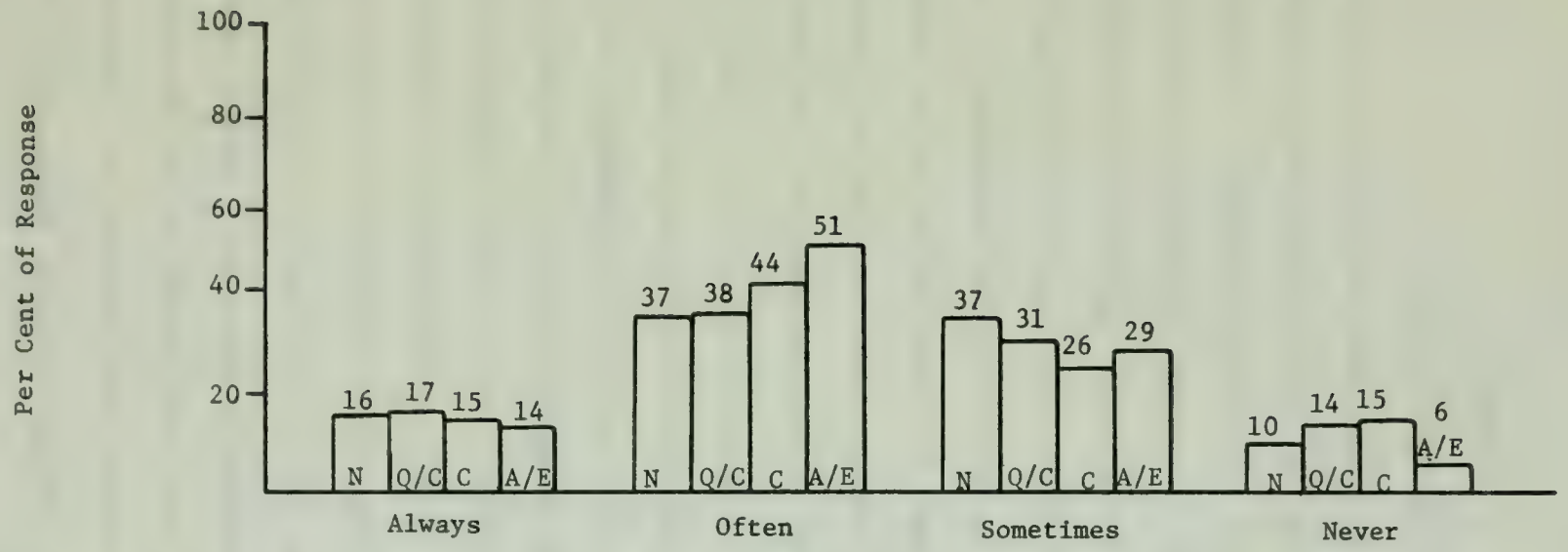


Figure 105 Responses from Civilian and Navy Related Respondents to Question 10f/10e/4n. Do you think that Contractor responsibility for inspection lends itself to a Construction Management type of contract?

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The responsibility that each member of the building team has for inspection and quality control can have a significant effect on the quality of a construction project. The interest of the owner in this area is of paramount importance. He must place his trust and confidence in the design professional's ability to produce a good design with a high quality set of plans and specifications. During the construction phase prompt decisions and payment to the contractor for the work in place, the change orders and the extras is necessary for him to be able to furnish the quality of workmanship specified. The inspector must be experienced and capable. His knowledge of industry quality standards when related to his thorough understanding of the contract documents will contribute to the just discharge of his duties. From his experience he can use good judgment in the proper trade-offs, alternatives, and necessary remedial actions that can maintain the job momentum. The timeliness of his decisions and of his discovery of potential problems can be of assistance to the contractor. The team approach can help the job to be built within the estimate and eliminate unnecessary costs. The payment of adequate fees for satisfactory inspection and quality control under these conditions can benefit the contractor, the designer, and the owner in lower project costs, reduced claims, better quality construction, less maintenance

costs, better working relationships and earlier job completion.

Both the architect/engineer and contractor respondents have indicated that they like to have inspection on their projects. They feel that a satisfactory level of inspection can help to ensure quality, find mistakes, and reduce costs and that this level of inspection is not too expensive to provide. The cost of inspection and quality control is relatively much higher on projects with a contract price of less than $500,000. When asked what type of inspection has been provided the most satisfactorily by designers, the architect/engineers rated interpretation of the plans and specifications the highest, whereas, the contractors indicated that it is job progress inspection. It is believed that the respondents rated these two types the highest because they feel that this is the most important function of inspection. Most of the respondents in these two groups feel that the designer and/or his representative should inspect the work. The contractors placed twenty percent of their responses for responsibility for the inspection and quality control in the contractor category. The architect/engineers feel that their traditional role as the representative of the owner during construction should not be changed under the normal conditions of the contract which includes a one year warranty. Some of the contractors have indicated that they want to take a greater part in the inspection functions. Each group feels that they are responsible members of the building team who are trying to get the most quality with the least amount of unnecessary costs. The results of their responses indicate that they believe that satisfactory inspection can help to achieve that goal.

Twenty seven percent of the architect/engineers were willing to allow the contractor to have the sole responsibility for the inspection with an extended warranty of three years. The designer responsibilities in this special contract included interpretation of the plans and specifications and final acceptance of the completed job. These architect/engineers who have consented to the Contractor Quality Control (CQC) program with the extended warranty have indicated that they have a high regard for inspection and the level of quality that contractors provide. They feel that inspection is an aid to construction and is no substitute for the contractor's responsibility to provide the specified quality of workmanship. It is believed that two reasons affected their decision to use CQC in some of their contracts. The first involves fee problems and additional cost to the owner, and the second is based upon the belief that the contractor should be responsible for the quality control of his materials and workmanship. It can be concluded that the cost of inspection and quality control should be determined. This information could help to establish standard fee structures. It could also greatly benefit owners, designers, and contractors in establishing project cost estimates and in controlling costs during construction.

There were twenty seven (73%) architect/engineers who did not want the contractor to have the sole responsibility for the inspection, even under an extended warranty. These designers, who want to retain the inspection responsibility place greater emphasis on the ability of satisfactory inspection to ensure quality. They believe that the designer is the team member who can best inspect,

and that there would be a conflict of interest if the contractor had the sole responsibility for the inspection. They indicate that they should continue in their traditional role as the representative of the owner during construction.

Forty four percent of the contractor respondents have indicated that they would like to have the sole responsibility for the inspection, even with a one and a half year extended warranty. These contractors who want to accept this responsibility believe that they could inspect the work better than the designer. They want to perform the testing, quality control inspection, and the approval of submittals (i.e. shop drawings, etc.). They do not feel that there would be a conflict of interest if they performed these duties. They believe that the contractor should always be responsible for the quality of his work.

There were fifteen contractors (56%) who did not want to have the sole responsibility for the inspection as part of their contract. They have a high regard for designer inspection but they have indicated that the contractor should "always" be responsible for the quality of his work. Contractor responsibility for the inspection to these respondents more often constitutes a conflict of interest.

In the analysis of the Navy's CQC program many of the questions were found to have diverse answers. This indicates that CQC may not be administered uniformly. There is also evidence of the existence of friction between the Navy construction inspectors and the CQC representatives. The three groups analyzed in this section, which are contractors (called CQC contractors in this study), CQC

representatives and Navy personnel, generally have found that CQC "often" has reduced submittal approval time, given the contractor more control of his operations and helped to identify construction problems and solutions earlier. "Sometimes" CQC helps to get the job off to a smoother start. More specificity is wanted in the required numbers and qualifications of CQC personnel. All three groups of respondents in this section believe that the contractor should have a significant amount of responsibility for the inspection and quality control. Both the CQC contractors and representatives feel that the Navy is getting better work now with the CQC program than before when the Navy had the sole responsibility for the inspection. They have indicated that this is happening with a minimal conflict of interest.

The contractor respondents want the CQC representative and the superintendent to be the same person on projects less than $1 million, and the CQC representatives and Navy personnel agree, but at a limit of $500,000. All three groups have indicated that the cost of inspection on projects less than $500,000 is relatively much higher than on larger projects. They have also indicated that the contractors who do work in this range generally provide a level of quality that is somewhat less than the quality provided on larger contracts. The effectiveness of the inspection function could be reduced if the CQC representative and the superintendent were the same man because the inspector would no longer be on the job site to check, observe, and expedite construction. This could, in some cases, develop into a conflict of interest. It is recommended that the use of CQC on contracts less than $500,000 be

eliminated and that the Navy should assume the responsibility for the inspection on contracts in this range.

The fifty two percent of the Navy personnel who want to delete the CQC provisions from their contract and return the responsibility for the inspection to the Navy have the most diverse opinions of all of the respondents. They believe that there is "always" a conflict of interest with CQC, and that the CQC representative can rarely be on the contractor's payroll and properly inspect the work. They have indicated that the Navy "never" gets better completed work as a result of the CQC program than they did when the Navy performed all of the inspection. When asked who should be responsible for the inspection, they responded that the contractor should share the responsibility for quality control and job progress inspection with the Navy. It can be concluded that these personnel believe that the Navy has given the contractor too much responsibility in the CQC program.

The Navy personnel who want to keep the CQC provisions in the contract (48%) believe that most contractors provide a level of quality that is equal to or greater than that specified. They believe that contractors have often had a good regard for inspection, and that the inspection they provide under CQC has often been satisfactory.

There were thirty CQC contractors who responded to the questionnaire. They would like more specificity in the contract documents about CQC personnel requirements. These CQC contractors believe that there is not a problem with conflict of interest in this program, and that the CQC representative can be on the

contractor's payroll and properly inspect the work.

Thirty seven percent of the CQC contractors indicated that they want to delete the CQC provisions from the contract and have the Navy perform the inspection. They feel that some Navy personnel do not understand CQC and have a low regard for the program. They believe that the Navy usually overinspects their CQC projects. They have found that good CQC representatives are always difficult to find and that the cost of CQC is often too expensive to provide.

Sixty three percent of the CQC contractors want to keep the CQC provisions in their contracts. They believe that CQC projects provide the Navy with better completed work. These contractors have indicated that CQC gives them more control of their own operations and that it reduces submittal approval time. They have found that the CQC plan and the three stage inspection program are usually effective. The benefits of CQC to the contractors in this group surpass the costs of the program to the owner.

Inspection and quality control may be defined differently according to the interests of the owner, the designer, and the contractor. The justification for its use has its basis in the cost and quality of the project. Contractor quality control, as used by the Navy, was developed because the Navy wanted to give the contractor more control of his own operations with the ultimate goal of getting better quality work. The contractor is required to adhere to the CQC provisions in his Navy contract. The CQC plan and organization are an assurance for the Navy that the contractor does have a functioning program for the control of quality. The Navy related respondents have indicated that a similar program

could "often" work on nongovernment projects. Only thirty four percent of the architect/engineers and contractors were willing to add CQC provisions to their contracts with an extended warranty. Out of the 160 respondents in this analysis, 48% want CQC provisions in their contracts.

The use of CQC on nongovernment construction can be justified on those projects in which cooperation among the members of the building team can be expected. Projects greater than $1 million can adequately support such a program with a contractor quality control organization on the construction site. The respondents who indicated an interest in having CQC provisions in their contracts did so under the condition that the owner's representative provide an inspection function in addition to that of the contractors. Both the designers and the CQC contractors have found that the fee for their inspection programs is about two percent of the total contract award price. The cost of the total inspection package for all types of CQC programs in relation to the expected level of quality should be a significant consideration. The team effort involved in a quality control program such as the Navy's is an excellent method of ensuring that the owner receives the most for his construction dollar.

LIST OF ACRONYMS

ACI	American Concrete Institute
AIA	American Institute of Architects
AIAHPP	American Institute of Architects Handbook of Professional Practice
ASCE	American Society of Civil Engineers
ASPR	Armed Services Procurement Regulations
BRAB	Building Research Advisory Board
CEC	Consulting Engineers Council
COE	Corps of Engineers, U. S. Army
CQC	Contractor Quality Control
EFD	Engineering Field Division, Naval Facilities Engineering Command, U. S. Navy
GSA	General Services Administration
HEW	U. S. Department of Health, Education, and Welfare
MPCE	Manual of Practice of Consulting Engineering
NAVFAC	Naval Facilities Engineering Command, U. S. Navy
NCIS	Navy Construction Inspection System
ROICC	Resident Officer in Charge of Construction
VA	Veterans Administration

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APPENDICES

APPENDIX A

Letter and Questionnaire Sent to Civilian Architect/Engineers and Contractors

March 14, 1974

Dear Sir:

I would like to invite your participation in a research effort important to the construction industry. This research requires that information about the responsibility for inspection and quality control be gathered from established firms associated with construction. Since it is impossible to interview personnel with every firm, a carefully selected sample is being asked to complete a questionnaire. Your firm is one of those selected, and I would ask your cooperation in completing the attached questionnaire and returning it to me in the stamped, addressed envelope enclosed with this letter. The questionnaire should take about ten minutes to complete and requires very little writing.

This research is being done for a thesis in the Construction Engineering and Management Masters Degree program. I sent out a limited number of questionnaires so your response is vitally important; your answers will be confidential and will be combined with others to establish a basis for the Industry's feelings on this subject. Please answer the questions from your firm's viewpoint. Every job is different and a few of the questions may seem too general, but please consider your firm's past experiences and answer them on a weighted average basis. When contract ranges are given, please answer the questions in the area that applies to you. This is your chance to have your feelings about the responsibility for inspection and quality control set down in a paper that will be available for the Construction Industry to use.

The Construction Engineering Office of the Naval Facilities Engineering Command, Washington, D. C. and the Architectural Engineering Division of the Department of Civil and Environmental Engineering at the University of Colorado in Boulder through my advisor, Professor Walter Meyer (past President of AGC, Building Chapter of Colorado, Inc.) are sponsoring this research in this controversial but important area. If you would like the results

of this study, and to ensure the confidentiality of your responses, please send me your address under separate cover. Your help is important to the completion of this research and will be greatly appreciated. Thank you for your time and effort.

Sincerely,

Joseph C. Dean
LT(jg), CEC, USN

JCD/dm

QUESTIONNAIRE

A) What is your position in your organization? (check one) ____President; ____Vice-President; ____Chief Inspector; ____ Inspector; ____Other (specify_____).

B) How would you classify your business? (check one) ____Architect; ____Engineer; ____Other (specify_____).

C) Primary Type(s) of design work of your organization: (check as appropriate) ____Commercial; ____Industrial; ____Residential; ____Other Buildings (specify_____); ____Highways: ____Bridges; ____Tunnels; ____Dams; ____Runways; ____Water; ____Sewerage; ____Pipelines; ____Others (specify_____).

D) What is your approximate annual contract award volume (award to contractor)? (check one) ____Under $100,000; ____$100,000 - 499,999; ____$500,000 - 999,999; ____$1 - 4.99 million; ____$5 - 9.99 million; ____10 million and greater.

NOTE: The term "designer" in this questionnaire will be used and will stand for your response in (B) above.

****

1) What is the frequency in the four areas noted below of the total amount of inspection by people in your organization or consultants working for you, including private inspection firms, that you would define as satisfactory. Answer in the job size columns that apply to your company considering the type of work that you do. (Enter frequency: ie, as needed, 1 hr/wk, fulltime, none, etc.)

	Up to $100,000	$100,000 to $500,000	$500,000 to $1 Million	$1 Million to $3 Million	$3 Million and Greater
a) Interpretation of the Plans and Specifications					
b) Quality Control Inspection					
c) Job Progress Inspection					
d) Final Acceptance of each stage of the work					

2) Who should perform the inspections mentioned in Question (1)? (Please enter below the appropriate number from the following categories:)
(1) Architect (part time); (2) Architect ("clerk of the works");
(3) Engineer (part time); (4) Engineer ("clerk of the works");
(5) Contractor; (6) Design Engineer contracted by the Architect;
(7) Other (specify)_____ . (Please note if the responsibility should be shared, with the applicable percentages.)

	Up to $100,000	$100,000 to $500,000	$500,000 to $1 Million	$1 Million to $3 Million	$3 Million and Greater
a) Interpretation of the Plans and Specifications					
b) Quality Control Inspection					
c) Job Progress Inspection					
d) Final Acceptance of each stage of the work					

3) In your opinion, have the Designers that you have worked with: (check one answer per question)

	Always	Often	Sometimes	Never
a) Had a good regard for inspection				
b) Used inspection to get work that is not clearly shown in the Plans and Specifications				
c) Provided satisfactory interpretation of Plans and Specifications				
d) Provided satisfactory Quality Control Inspection				
e) Provided satisfactory Job Progress Inspection				
f) Provided satisfactory Final Acceptance Inspection of each stage of the work				

	Always	Often	Sometimes	Never
g) Provided satisfactory structural inspection				
h) Provided satisfactory mechanical inspection				
i) Provided satisfactory electrical inspection				

4) Please consider the cost and status of inspection today along with how it has been received by the contractors you have worked with:

a) What percentage of the total contract award price does inspection usually run?_____%

b) Do you feel that: (check one answer per question)

	Always	Often	Sometimes	Never
i) Good inspectors are difficult to find				
ii) Inspection is a good tool to ensure that the contractor provides the level of quality specified in the contract				
iii) Inspection is a good tool to help even the best of contractors find mistakes				
iv) The cost of "satisfactory" inspection is too high to provide				
v) Inspection is a service that you like to have on your jobs				
vi) Owners are willing to pay for satisfactory inspection				

5) How often do you require the contractor to redo work because it is not satisfactory: (check one) ____Never; ____1-5%; ____6-10%; ____11-15%; ____16-20%; ____21% and greater.

6) How often does the contractor on his own initiative require his forces to redo work that is not satisfactory? (check one)
____Never; ____1-5%; ____6-10%; ____11-15%; ____16-20%;
____21% and greater.

7) To your knowledge, do contractors in the following categories have a tendency to provide: (check one in each column)

	Up to $100,000 per award	Up to $500,000 per award	Up to $1Million per award	Up to $3Million per award	Unlimited per award
a) Just enough Quality Control to get by					
b) Level of Quality Control that is required by the Plans/ Specifications as interpreted by the Designer					
c) Level of Quality Control that is higher than (b) to enhance company reputation					

8) Would you prefer to have the option of a quality of construction clause which has incorporated into it a warranty of construction provision where:

i) the contractor had full responsibility for the inspection services with an extended warranty period, and
ii) the owner/designer had the responsibility for payment, periodic checks to ensure that the contractor's inspection program is functioning properly, and final acceptance of the completed job? (check one) ____Yes; ____No.

9) If your answer to (8) was Yes, please respond to the following questions:

a) What extended warranty period would you consider reasonable?
_____Years
b) Under the contract in question (8) would you like to see the contractor have the following responsibilities? (check one answer per question)

	Yes	No
i) The contractor would approve his own shop drawings.		
ii) The contractor would provide his own Quality Control Inspection.		
iii) The contractor would perform his own Final Acceptance Inspection of each stage of the work.		
iv) The contractor would be responsible for testing under the contract.		
v) The designer would interpret the plans and specifications.		
vi) The contractor would submit periodic inspection reports to the designer.		
vii) The contractor would be required to have a Quality Control Branch of his organization to perform (i) through (vi).		

10) Do you think that: (check one answer per question)

	Always	Often	Sometimes	Never
a) Satisfactory inspection reduces the cost of construction for the contractor				
b) Owners feel that inspection is important to the quality of the job				
c) Contractors welcome satisfactory inspection				
d) The contractor can have the sole responsibility for inspection and properly inspect a job better than the designer				
e) There would be a conflict of interest if the contractor inspected his own work				

	Always	Often	Sometimes	Never
f) Contractor responsibility for inspection lends itself to a Construction Management type of contract				
g) The contractor should be responsible for the quality of his job				

11) Have you ever had a contract where you required the contractor to perform the inspection services as part of his contractural obligations? ____Yes; ____No.

12) Any other comments that you would like to make about inspection and the responsibility for inspection will be appreciated.

Thank you for your help, you will find a stamped and addressed envelope enclosed for your convenience. If you would like the results of this study please send your address under separate cover. This will ensure the confidentiality of your responses.

QUESTIONNAIRE

A) What is your position in your organization? (check one) ____President; ____Vice-President; ____Project Manager; ____ Chief Inspector; ____Inspector: ____Other (Please specify _____).

B) How would you classify your business? (check one) ____General Contractor; ____Specialty Contractor (specify_____); ____Other (specify_____).

C) Primary type(s) of work that your company performs: (check as appropriate): ____Commercial; ____Industrial; ____Residential; ____Other Buildings (specify_____); ____Highways; ____Tunnels; ____Bridges; ____Dams; ____Runways; ____Water; ____Sewerage; ____Pipelines; ____Others (specify_____).

D) What is your approximate annual contract award volume? (check one) ____Under $100,000; ____$100,000-499,999; ____$500,000-999,999; ____$1 - 4 Million; ____$5 - 9.9 Million; ____$10 Million +.

NOTE: The term "designer" in this questionnaire will represent the Engineer or the Architect. If your firm works primarily with the Engineer Designer, as in water and sewerage systems, please answer the following questions considering the engineer. The same will apply to the architectural designer.

E) In your type of work do you deal primarily with the: (check one) ____Engineer; ____Architect.

****

1) What is the frequency in the four areas noted below of the total amount of inspections (excluding municipal building inspections) that you would define as satisfactory. Answer in the job size columns that apply to your company considering the type of work that you do. (Enter frequency: ie, as needed, 1 hr/wk, fulltime, none, etc.)

	Up to $100,000	$100,000 to $500,000	$500,000 to $1 Million	$1 Million to $3 Million	$3 Million and Greater
a) Interpretation of the Plans and Specifications					
b) Quality Control Inspection					
c) Job Progress Inspection					

	Up to $100,000	$100,000 to $500,000	$500,000 to $1 Million	$1 Million to $3 Million	$3 Million and Greater
d) Final Acceptance of each stage of the work					

2) Who should perform the inspections mentioned in Question (1)? (Please enter below the appropriate number from the following categories: (1) Architect (part time); (2) Architect ("clerk of the works"); (3) Engineer (part time); (4) Engineer ("clerk of the works"); (5) Contractor; (6) Design Engineer contracted by the Architect; (7) Other (specify)_____. (Please note if the responsibility should be shared with the appropriate percentages.)

	Up to $100,000	$100,000 to $500,000	$500,000 to $1 Million	$1 Million to $3 Million	$3 Million and Greater
a) Interpretation of the Plans and Specifications					
b) Quality Control Inspection					
c) Job Progress Inspection					
d) Final Acceptance of each stage of the work					

3) Do you feel that the Designers that you have worked with have: (check one answer per question)

	Always	Often	Sometimes	Never
a) Had a good regard for inspection				
b) Used inspection to get work that is not clearly shown in the Plans and Specifications				
c) Provided satisfactory interpretation of Plans and Specifications				

	Always	Often	Sometimes	Never
d) Provided satisfactory Quality Control Inspection				
e) Provided satisfactory Job Progress Inspection				
f) Provided satisfactory Final Acceptance Inspection of each stage of the work				
g) Provided satisfactory electrical inspection				
h) Provided satisfactory structural inspection				
i) Provided satisfactory mechanical inspection				

4) Do you feel that: (check one answer per question)

	Always	Often	Sometimes	Never
a) Good inspectors are difficult to find				
b) Inspection is a good tool to ensure that the contractor provides the level of quality specified in the contract				
c) Inspection is a good tool to help even the best of contractors find mistakes				
d) Inspection is a service that you like to have on your job				
e) The cost of "satisfactory" inspection is too expensive to provide				

5) To your knowledge, do contractors in the following categories have a tendency to provide: (check one in each column).

	Up to $100,000 per award	Up to $500,000 per award	Up to $1Million per award	Up to $3Million per award	Unlimited per award
a) Just enough Quality Control to get by					
b) Level of Quality Control that is required by Plans and Specifications					
c) Level of Quality Control that is higher than (b) to enhance company reputation					

6) How often do you require your forces on your own initiative to redo work because you think that it is not satisfactory? (check one) ____Never; ____1-5%; ____6-10%; ____11-15%; ____16-20%; ____21% and greater.

7) How often does the Architect require you to redo work because he thinks that it is not satisfactory? (check one) ____Never; ____1-5%; ____6-10%; ____11-15%; ____16-20%; ____21%+.

8) Would you prefer to have the option of a quality of construction clause which has incorporated into it a warranty of construction provision where:

   i) the contractor had full responsibility for the inspection services with an extended warranty period, and

   ii) the owner/designer had the responsibility for payment, periodic checks to ensure that the contractor's inspection program is functioning properly, and final acceptance of the completed job?

   (check one) ____Yes; ____No.

9) If your answer to (8) was YES, please respond to the following questions:

   a) What extended warranty period would you consider reasonable? _____Years.

   b) Under the contract in question (8) would you like to have the following responsibilities? (check one answer per question).

	Yes	No
i) You could approve your own shop drawings.		
ii) Perform your own Quality Control Inspection.		
iii) Perform your own Final Acceptance Inspection of each stage of the work.		
iv) Be responsible for the testing under the contract.		
v) Interpretation of the Plans and Specifications by the designer.		
vi) Submit periodic inspection reports to the designer.		
vii) Be required to have a Quality Control Branch of your organization to perform (i) through (vi).		

10) Do you think that: (check one answer per question)

	Always	Often	Sometimes	Never
a) Satisfactory inspection reduces the cost of construction for your company				
b) Owners feel that inspection is important to the quality of the job				
c) Your firm can have the sole responsibility for inspection and properly inspect a job better than the designer				
d) There would be a conflict of interest if your firm inspected its own work				
e) Contractors responsibility for inspection lends itself to a Construction Management type of contract				
f) The contractor should be responsible for the quality of his job				

11) Have you ever had a contract where you had the responsibility for the inspection? ____Yes; ____No; if yes, please explain (ie, Navy - CQC, etc.)

12) Any other comments that you would like to make about inspection and the responsibility for inspection will be appreciated.

Thank you for your help; you will find a stamped and addressed envelope enclosed for your convenience. If you would like the results of this study please send your address under separate cover. This will ensure the confidentiality of your response.

APPENDIX B

Letter and Questionnaire Sent to Navy Personnel and Contractor Quality Control Representatives

March 14, 1974

Dear Sir:

I would like to invite your participation in a research effort important to the Navy and the construction industry. This research requires that information about the responsibility for inspection and quality control as it relates to Contractor Quality Control (CQC) be gathered from experienced ROICCs, AROICCs, inspectors and CQC contractors. Since it is impossible to interview personnel with every office, a carefully selected sample is being asked to complete a questionnaire. You are one of those selected, and I would ask your cooperation in completing the attached questionnaire and returning it to me in the stamped, addressed envelope enclosed with this letter. The questionnaire should take about ten minutes to complete and requires very little writing.

This research is being done for a thesis in the Construction Engineering and Management Masters Degree program. I sent out a limited number of questionnaires so your response is vitally important; your answers will be confidential and will be combined with others to establish a basis for the Industry's feelings on this subject. Please answer the questions from your viewpoint. Every job is different and a few of the questions may seem too general, but please consider your past experiences and answer them on a weighted average basis. When contract ranges are given, please answer the questions in the area that applies to you. This is your chance to have your feelings about CQC set down in a paper that will be available for the Construction Industry and the Navy to use.

I have enclosed two extra copies for anyone in your office that you think might like to contribute his ideas to this research, especially AROICCs and Inspectors. Also enclosed is a questionnaire for a CQC representative. If you have time please give it to one of your CQC representatives so that I can get his ideas too. I realize that you are very busy, but I think that this research will give the Corps a better idea of how CQC is working as well as areas where we can improve the program.

The Construction Engineering Office of the Naval Facilities Engineering Command, Washington, D. C. and the Architectural Engineering Division of the Department of Civil and Environmental Engineering at the University of Colorado in Boulder through my advisor, Professor Walter Meyer (past President of AGC, Building Chapter of Colorado, Inc.), are sponsoring this research in this controversial but important area. If you would like the results of this study, and to ensure the confidentiality of your responses, please send me your address under separate cover. Your help is important to the completion of this research and will be greatly appreciated. Thank you for your time and effort.

Sincerely,

Joseph C. Dean
LT(jg), CEC, USN

JCD/dm

QUESTIONNAIRE

A) What is your position in your office? (check one) ____ROICC; ____AROICC; ____Inspector/Construction Representative; ____Other (specify_____).

B) What is your rank (military or civil service)?_____

C) How many CQC contracts have you had in the following contract ranges? (enter number where appropriate, i.e., 1, 2, 3, etc) ____$100,000-499,999; ____$500,000-999,999; ____$1-4 Million; ____$5-9.99 Million; ____$10 Million and greater.

D) How many CQC contracts have you had in the following categories? (enter number of contracts where appropriate) ____Commercial; ____Industrial; ____Residential; ____Other Buildings (specify _____); ____Highways; ____Bridges; ____Tunnels; ____Dams; ____Runways; ____Water; ____Sewerage; ____Pipelines; ____Others (specify_____).

****

1) Listed below are four basic areas of inspection which may be performed by both the CQC Representative and the Navy Construction Representative or many other individuals. Please enter the frequency of the total amount of inspection from all sources that you consider satisfactory. Consider the type and size of CQC contracts that you have administered and enter the frequency in the four areas listed below under the appropriate contract range column. (Enter frequency; i.e., 1 hr/wk, fulltime, as needed, none, etc.)

	Up to $100,000	$100,000 to $500,000	$500,000 to $1 Million	$1 Million to $3 Million	$3 Million and Greater
a) Interpretation of the Plans and Specifications					
b) Quality Control Inspection					
c) Job Progress Inspection					
d) Final Acceptance of each stage of the work					

2) Who do you think should perform the inspections mentioned in Question (1)? (Please enter below the appropriate number from the following categories: (1) Navy (part time); (2) Navy ("clerk of the works"); (3) Contractor (part time); (4) Contractor ("clerk of the works"/CQC Representative); (5) Design Architect/Engineer (part time); (6) Design Architect/Engineer ("clerk of the works"); (7) Other (specify_____) Please note if the responsibility should be shared with the appropriate percentages).

	Up to $100,000	$100,000 to $500,000	$500,000 to $1 Million	$1 Million to $3 Million	$3 Million and Greater
a) Interpretation of the Plans and Specifications					
b) Quality Control Inspection					
c) Job Progress Inspection					
d) Final Acceptance of each stage of the work					

3) Do you feel that the Navy ROICC office personnel that you have worked with on CQC jobs have: (check one answer per question)

	Always	Often	Sometimes	Never
a) Had a good regard for inspection				
b) Used inspection to get work that is not clearly shown in the Plans and Specifications				
c) Provided satisfactory interpretation of Plans and Specifications				
d) Provided satisfactory surveillance/inspection of the contractor's CQC program.				
e) Had a good regard for the CQC program				

4) Do you feel that: (check one answer per question)

	Always	Often	Sometimes	Never
a) Inspection is a good tool to ensure that the contractor provides the level of quality specified in the contract				
b) Inspection is a good tool to help even the best of contractors find mistakes				
c) Inspection is a service that you like to have on your job				
d) The cost of a "satisfactory" CQC program is to expensive to provide				
e) The contractor should be responsible for the quality of his job				
f) Good CQC representatives are difficult to find				
g) CQC increases job productivity				
h) CQC reduces submittal approval time				
i) CQC gets the job off to a smoother start				
j) CQC gives the contractor more freedom in controlling his own operations				
k) CQC helps the contractor to recognize construction problems and solutions earlier				
1) Inspection by the contractor gives the Navy a better completed job than under the old Navy Construction Inspection System				
m) There is a conflict of interest because the contractor is inspecting his own work				
n) Contractor inspection lends itself to a Construction Management type of contract				

5) To your knowledge, do contractors in the following categories have a tendency to provide: (check one in each column).

	Up to $100,000 per award	Up to $500,000 per award	Up to $1Million per award	Up to $3Million per award	Unlimited per award
a) Just enough Quality Control to get by					
b) Level of Quality Control that is required by Plans and Specifications as interpreted by the ROICC					
c) Level of Quality Control that is higher than (b) to enhance company reputation					

6) How often do you require the contractor to redo work, because it is not satisfactory: (check one) ____Never; ____1-5%; ____6-10%; ____11-15%; ____16-20%; ____21% and greater.

7) How often does the contractor on his own initiative require his forces to redo work that is not satisfactory? (check one) ____Never; ____1-5%; ____6-10%; ____11-15%; ____16-20%; ____21%+.

8) In considering past CQC contracts, do you think that: (check one answer per question)

	Always	Often	Sometimes	Never
a) Navy personnel have understood CQC				
b) The CQC Representative can be on the contractor's payroll and properly inspect the work				
c) The Navy overinspects its CQC jobs				
d) The CQC plan is a valuable asset to the contractor's inspection program				
e) The three stage inspection operation (preparatory, initial, follow-up) gives the contractor a satisfactory inspection program				

	Always	Often	Sometimes	Never
f) The Navy should specify the number and qualifications of CQC personnel in the contract				
g) The CQC requirements in the various divisions of the contract give the contractor enough information to plan a good CQC program				
h) A program like CQC could be used on non-government jobs				

9) Do you feel that the CQC contractors that you have worked with have: (check one answer per question)

	Always	Often	Sometimes	Never
a) Had a good regard for inspection				
b) Provided satisfactory Quality Control Inspection				
c) Provided satisfactory Job Progress Inspection				
d) Provided satisfactory Final Acceptance Inspection of each stage of the work				
e) Provided satisfactory mechanical inspection				
f) Provided satisfactory electrical inspection				
g) Provided satisfactory structural inspection				
h) Provided satisfactory preliminary inspection				
i) Provided satisfactory initial inspection				
j) Provided satisfactory follow-up inspection				

10) At what contract dollar value shall the job superintendent and the CQC representative be the same man? (check one answer) ____Never; ____less than $50,000; ____less than $100,000; ____less than $250,000; ____less than $500,000; ____less than $1 million; ____less than $3 million.

11) Would you prefer to return to the Navy Construction Inspection System and delete the CQC provisions from the contract? ____Yes; ____No

12) Any other comments that you would like to make concerning Contractor Quality Control in the Navy would be appreciated.

Thank you for your help; you will find a stamped and addressed envelope enclosed for your convenience. If you would like the results of this study please send your address under separate cover. This will ensure the confidentiality of your response.

APPENDIX C

Letter and Questionnaire Sent to Contractors in the Navy's Contractor Quality Control Program

March 14, 1974

Dear Sir:

I would like to invite your participation in a research effort important to the construction industry. This research requires that information about the Navy's Contractor Quality Contraol (CQC) Program be gathered from established firms associated with construction. Since it is impossible to interview personnel with every firm, a carefully selected sample is being asked to complete a questionnaire. Your firm is one of those selected, and I would ask your cooperation in completing the attached questionnaire and returning it to me in the stamped, addressed envelope enclosed with this letter. The questionnaire should take about ten minutes to complete and requires very little writing.

This research is being done for a thesis in the Construction Engineering and Management Masters Degree program. I sent out a limited number of questionnaires so your response is vitally important; your answers will be confidential and will be combined with others to establish a basis for the Industry's feelings on this subject. Please answer the questions from your firm's viewpoint. Every Navy CQC job is different and a few of the questions may seem too general, but please consider your firm's past experiences and answer them on a weighted average basis. When contract ranges are given, please answer the questions in the area that applies to you. This is your chance to have your feelings about the responsibility for inspection and quality control as it applies to CQC set down in a paper that will be available for the Construction Industry to use.

The Construction Engineering Office of the Naval Facilities Engineering Command, Washington, D. C. and the Architectural Engineering Division of the Department of Civil and Environmental Engineering at the University of Colorado in Boulder through my advisor, Professor Walter Meyer (past President of AGC, Building Chapter of Colorado, Inc.), are sponsoring this research in this

controversial but important area. If you would like the results of this study, and to ensure the confidentiality of your responses, please send me your address under separate cover. Your help is important to the completion of this research and will be greatly appreciated. Thank you for your time and effort.

Sincerely,

Joseph C. Dean
LT(jg), CEC, USN

JCD/dm

QUESTIONNAIRE

A) What is your position in your organization? (check one) ____President; ____Vice-President; ____Project Manager; ____Chief Inspector; ____Inspector; ____Other (specify _____).

B) How would you classify your business? (check one) ____General Contractor; ____Specialty Contractor (specify_____). ____Other (specify_____).

C) What is your approximate annual contract award volume? (check one) ____Under $100,000; ____$100,000-499,999; ____$500,000-999,999; ____$1-4.99 Million; ____$5-9.99 Million; ____$10 Million and greater.

D) Primary type(s) of CQC work that your company has performed for the Navy (check as appropriate): ____Commercial; ____Industrial; ____Residential; ____Other Buildings (specify_____); ____Highways; ____Bridges; ____Tunnels; ____Dams; ____Runways; ____Water; ____Sewerage; ____Pipelines; ____Others (specify _____).

E) How many CQC contracts have you had in the following contract ranges: (enter the number, i.e., 1, 2, 3, etc. where appropriate). ____Up to $100,000; ____$100,000 to 500,000; ____$500,000 to $1 Million; ____$1 Million to $3 Million; ____$3 Million +.

****

1) What is the frequency of the total amount of inspection on Navy CQC contracts in the four areas noted below that you would consider as being "satisfactory". Consider the type and size of contracts that you do and respond in the applicable contract range given: (enter frequency: i.e., 1 hr/wk, fulltime, as needed, none, etc.)

	Up to $100,000	$100,000 to $500,000	$500,000 to $1 Million	$1 Million to $3 Million	$3 Million and Greater
a) Interpretation of the Plans and Specifications					
b) Quality Control Inspection					
c) Job Progress Inspection					
d) Final Acceptance of each stage of the work					

2) Who do you think should perform the inspection mentioned in Question (1)? (Please enter below the appropriate number from the following categories: (1) Navy (part time); (2) Navy ("clerk of the works"); (3) Contractor (part time); (4) Contractor ("clerk of the works"/CQC Representative); (5) Design Architect/Engineer (part time); (6) Design Architect/Engineer ("clerk of the works"); (7) Other (specify_____). Please note if the responsibility should be shared with the appropriate percentages.

	Up to $100,000	$100,000 to $500,000	$500,000 to $1 Million	$1 Million to $3 Million	$3 Million and Greater
a) Interpretation of the Plans and Specifications					
b) Quality Control Inspection					
c) Job Progress Inspection					
d) Final Acceptance of each stage of the work					

3) Do you feel that the Navy ROICC office(s) that you have worked with on CQC jobs have: (check one answer per question)

	Always	Often	Sometimes	Never
a) Had a good regard for inspection				
b) Used inspection to get work that is not clearly shown in the Plans and Specifications				
c) Provided satisfactory interpretation of Plans and Specifications				
d) Provided satisfactory Final Acceptance Inspection of the completed job				
e) Provided satisfactory surveillance/ inspection of your CQC program				
f) Had a good regard for the CQC Program				

4) Do you feel that: (check one answer per question)

	Always	Often	Sometimes	Never
a) Inspection is a good tool to ensure that the contractor provides the level of quality specified in the contract				
b) Inspection is a good tool to help even the best of contractors find mistakes				
c) Inspection is a service that you like to have on your job				
d) The cost of a "satisfactory" CQC Program is too expensive to provide				
e) The contractor should be responsible for the quality of his job				
f) Good CQC representatives are difficult to find				
g) CQC insures job productivity				
h) CQC reduces submittal approval time				
i) CQC gets the job off to a smoother start				
j) CQC gives you more freedom in controlling your own operations				
k) CQC helps you to recognize construction problems and solutions earlier				
l) Inspection by your own forces gives the Navy a better completed job than under the old Navy Construction Inspection System				
m) There is a conflict of interest because you are inspecting your own work				
n) Contractor responsibility for inspection lends itself to a Construction Management type of contract				

5) To your knowledge, do contractors in the following categories have a tendency to provide: (check one in each column)

	Up to $100,000 per award	Up to $500,000 per award	Up to $1Million per award	Up to $3Million per award	Unlimited per award
a) Just enough Quality Control to get by					
b) Level of Quality Control that is required by Plans and Specifications as interpreted by the ROICC					
c) Level of Quality that is higher than (b) to enhance company reputation					

6) How often do you require your forces on your own initiative to redo work because you think that it is not satisfactory? (check one) ____Never; ____1-5%; ____6-10%; ____11-15%; ____16-20%; ____21% and greater.

7) How often does the Navy require you to redo work because they think that it is not satisfactory? (check one) ____Never; ____1-5%; ____6-10%; ____11-15%; ____16-20%; ____21% +.

8) In considering past CQC contracts, do you think that: (check one answer per question)

	Always	Often	Sometimes	Never
a) Navy personnel have understood CQC				
b) The CQC Representative can be on the contractor's payroll and properly inspect the work				
c) The Navy overinspects its CQC jobs				
d) The CQC plan is a valuable asset to your inspection program				
e) The three stage inspection operation (preparatory, initial, follow-up) gives you a satisfactory inspection program				

	Always	Often	Sometimes	Never
f) The Navy should specify the number and qualifications of CQC personnel in the contract				
g) The CQC requirements in the various divisions of the contract give you enough information to plan a good CQC program				
h) A program like CQC could be successful on non-government jobs				

9) At what contract dollar value should the job superintendent and the CQC representative be the same man? (check one answer) ____Never; ____Less than $50,000; ____less than $100,000; ____less than $250,000; ____less than $500,000; ____less than $1 Million; ____less than $3 Million.

10) What % of the total contract award price does CQC usually run? _____%

11) Would you prefer to have the Navy perform the inspection and delete the CQC provisions from your contract? (check one) ____Yes; ____No

12) Any other comments that you would like to make about Contractor Quality Control in the Navy will be appreciated.

Thank you for your help; you will find a stamped and addressed envelope enclosed for your convenience. If you would like the results of this study please send your address under separate cover. This will ensure the confidentiality of your responses.

APPENDIX D

Navy Contractor Quality Control and Inspection Clauses

Excerpts from:
1) General Provisions, Standard Form 23-A (October 1969 Edition), General Services Administration
2) Additional General Provisions, NAVFAC 4330/5 (Rev. 6/72) (For use with SF 23A (October 1969))

Excerpts from: 1) General Provisions, Standard Form 23-A (October 1969 Edition), General Services Administration

11. SUPERINTENDENCE BY CONTRACTOR

The Contractor shall give his personal superintendence to the work or have a competent foreman or superintendent, satisfactory to the Contracting Officer, on the work at all times during progress, with authority to act for him.

2) Additional General Provisions, NAVFAC 4330/5 (Rev. 6/72) (For use with SF 23A (October 1969))

42. GOVERNMENT INSPECTORS (1965 JAN)

The work will be conducted under the general direction of the Contracting Officer and is subject to inspection by his appointed inspectors to insure strict compliance with the terms of the contract. No inspector is authorized to change any provision of the specifications without written authorization of the Contracting Officer, nor shall the presence or absence of an inspector relieve the Contractor from any requirements of the contract.

65. WARRANTY OF CONSTRUCTION (1970 SEP)

(a) In addition to any other warranties set out elsewhere in this contract, the Contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect of equipment, material or design furnished, or workmanship performed by the Contractor or any of his subcontractors or suppliers at any tier. Such warranty shall continue for a period of one year from the date of final acceptance of the work, but with respect to any part of the work which the Government takes possession of prior to final acceptance, such warranty shall continue for a period of one year from the date the Government takes possession. Under this warranty, the Contractor shall remedy at his own expense any such failure to conform or any such defect. In addition, the Contractor shall remedy at his own expense any damage to Government owned or controlled real or personal property, when that damage is the result of the Contractor's failure to conform to contract requirements or any such defect of equipment, material, workmanship, or design. The Contractor shall also restore any work damaged in fulfilling the terms of this clause. The Contractor's warranty with respect to work repaired or replaced hereunder will run for one year from the date of such repair or replacement.

(b) The Government shall notify the Contractor in writing within a reasonable time after the discovery of any failure, defect, or damage.

(c) Should the Contractor fail to remedy any failure, defect, or damage described in (a) above within a reasonable time after receipt of notice thereof, the Government shall have the right to replace, repair, or otherwise remedy such failure, defect, or damage at the Contractor's expense.

(d) In addition to the other rights and remedies provided by this clause, all subcontractors', manufacturers', and suppliers' warranties expressed or implied, respecting any work materials shall, at the direction of the Government, be enforced by the Contractor for the benefit of the Government. In such case if the Contractor's warranty under (a) above has expired, any suit directed by the Government to enforce a subcontractor's, manufacturer's or supplier's warranty shall be at the expense of the Government. The Contractor shall obtain any warranties which the subcontractors, manufacturers, or suppliers would give in normal commercial practice.

(e) If directed by the Contracting Officer, the Contractor shall require any such warranties to be executed in writing to the Government.

(f) Notwithstanding any other provision of this clause, unless such a defect is caused by the negligence of the Contractor or his subcontractors or suppliers at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage which results from any such defect in Government furnished material or design.

(g) The warranty specified herein shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistake, or fraud.

79. CONTRACTOR QUALITY CONTROL (CQC) (6-72)

(This clause applies only when specifically required by Division 1 "General Requirements" of the specifications)

(a) The contractor shall provide a quality control organization and system to perform inspections and tests of all items of work, including that of his subcontractors, to ensure conformance with the contract provisions. Quality Control will be established for all work, except where specific provisions of the contract provide for government approvals, inspections and tests. The contractor's quality control system will specifically include, but not be limited to, the inspections and tests required in the technical provisions of the contract specifications, and shall cover all construction operations, including both on-site and off-site fabrication.

(b) The contractor shall provide a CQC representative, supplemented as necessary by additional personnel, who shall be on the work at all times during progress, with complete authority to take any action necessary to ensure conformance with the contract. The CQC representative shall be appointed by a letter addressed to him and signed by an officer of the firm. This letter shall detail the CQC

representative's authority and responsibility to act for the contractor. The CQC representative shall report directly to an officer of the firm and shall not be subordinate to the job superintendent or project manager.

(c) The contractor shall furnish to the Government within (15) calendar days after receipt of the Notice of Award, a CQC Plan which shall detail the procedures, instructions, and reports to be used to assure conformance with the contract. Unless specifically authorized by the OICC/ROICC in writing, no construction will be started until the contractor's quality control plan is approved. This plan will include, as a minimum:

(1) A copy of the appointing letter to the contractor quality control representative, outlining his duties, responsibilities and authority, and signed by an officer of the firm. Included in this letter as a minimum, must be the authority to direct removal and replacement of any defective work.

(2) The quality control organization in chart form, showing the relationship of the quality control organization to other elements of the company.

(3) Names and qualifications of personnel in the quality control organization.

(4) Area of responsibility and authority of each individual in the quality control organization.

(5) A listing of outside organizations such as testing laboratories, architects, and consulting engineers that will be employed by the contractor, and a description of the services these firms will provide.

(6) Procedures for reviewing all shop drawings, samples, certificates, or other submittals for contract compliance, including the name of the person(s) authorized to sign the submittals for the contractor, as complying with the contract.

(7) An inspection schedule, keyed to the construction schedule, indicating what test will be performed, when testing will be performed, and by whom.

(8) Method of documenting the quality control operation, inspection, and testing, including a copy of all forms and reports to be used for this purpose.

(d) As a minimum, inspection procedures shall include:

(1) Preparatory Inspection. (Performed prior to beginning any work, or segment of work.) Preparatory inspection shall include a review of contract requirements; review and approval of shop drawings and submittal data for the work, or segment of work, (see paragraph (h) below); a check to assure that provisions have been made to provide required control testing; an examination of the work to ascertain that all preliminary work has been completed; and a physical examination of materials and equipment to assure that they conform to approved shop drawings or submittal data.

(2) Initial Inspection. (Performed as soon as a representative segment of the particular item of work has been accomplished.) Initial inspection shall include performance of scheduled tests, examination of the quality of workmanship, a review of test results for compliance with contract requirements, a review for omissions or dimensional errors, and approval or rejection of the initial segment of the work.

(3) Follow-up Inspections. (Performed daily or as frequently as necessary.) Continued testing and examinations to assure continuing compliance with contract requirements.

(e) After the contract is awarded, but before construction operations are started, the contractor shall meet with the OICC/ROICC, or his representative, and discuss the quality control requirements. The purpose of the meeting shall be to develop a mutual understanding relative to details of the system, including forms to be used for recording the quality control operations, inspections, tests, approvals, certifications, administration of the system, and government surveillance. This meeting shall also develop a schedule for future weekly or biweekly CQC meetings and shall establish procedures for submission of daily reports and other record documents.

(f) The contractor shall submit daily CQC reports to the OICC/ROICC, identifying prime and subcontractor personnel and equipment on the site, idle equipment and personnel, material deliveries, weather conditions; the work accomplished; the inspections and tests conducted; results of inspections and tests; nature of defects found; causes for rejection; proposed remedial action; and corrective actions taken; together with the following certification; "The above report is complete and correct and all material and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above." This certification shall be signed for the contractor by the duly authorized CQC representative.

(g) Where test results by a testing laboratory are provided, they shall site the contract requirements, the actual test results, and include a statement that the item tested conforms (or fails to conform) to the specification requirements.

(h) All submittals, shop drawings, catalog cuts, samples, etc., unless otherwise specifically noted, shall be approved and certified by the contractor as conforming to the plans and specifications. Four (4) copies of all shop drawings, catalog cuts, or other submittals, with the contractor's approval indicated thereon, shall be sent to the ROICC for record purposes, within one (1) working day of the contractor's approval.

APPENDIX E

Summary of Civilian (non-Government) Architect/Engineer and Contractor Responses to Questions A thru E

Information:
1) Position
2) Annual Contract Award Volume
3) Types of Work Performed
4) Company Classification

Note: All of the data in this Appendix and in Appendices E thru I is presented in tabular form according to the responses of the Architect/Engineer and the Contractors to question 8.

8) Would you prefer to have the option of a quality of construction clause which has incorporated into it a warranty of construction provision where:

   i) the contractor had full responsibility for the inspection services with an extended warranty period, and
   ii) the owner/designer had the responsibility for payment, periodic checks to ensure that the contractor's inspection program is functioning properly, and final acceptance of the completed job? (check one)
   ____Yes; ____No

In the tables a "Yes" response to question 8 is classified as "Yes to CQC" and a "No" is classified as "No to CQC".

	Contractors Responding Yes to CQC	Contractors Responding No to CQC	TOTAL	Architect/Engineers Responding Yes to CQC	Architect/Engineers Responding No to CQC	TOTAL
A) What is your position in your organization?						
President	4	6	10	1	6	7
Vice-President	4	1	5	3	7	10
Partner	1	1	2	2	2	4
Project Manager	1	5	6	1	-	1
Chief Inspector				1	2	3
Inspector				-	1	1
Owner				1	-	1
Estimator	-	1	1			
Head of Field Section	-	1	1	-	1	1
Chief Specifications				1	1	2
Secretary and/or Treasurer				-	2	2
Chief Engineer				-	2	2
Other	2	-	2	-	3	3
TOTAL	12	15	27	10	27	37
B) How would you classify your business?						
Architect				5	11	
Architect/Engineer				2	6	
Engineer				3	10	
General Contractor	9	12				
Speciality Contractor	1	1				
Electrical Contractor	1	-				
Mechanical Contractor	1	-				
Heavy/Highway Contractor	-	2				

C) Primary type(s) of work that your company performs: (Contractors only)
C) Primary type(s) of design work of your organization: (Architect/Engineers only)

	Contractors Responding Yes to CQC	Contractors Responding No to CQC	Architect/Engineers Responding Yes to CQC	Architect/Engineers Responding No to CQC
Commercial	12	11	9	18
Industrial	9	8	4	14
Residential	3	-	2	6
Other Buildings	3	1	-	3
Institutional	-	1	4	7
Religious			-	2
Schools			-	6
Military/Governmental			1	7
Research and Development			-	1
Site Preparation			-	1
Highways	1	3	-	5
Tunnels	1	-	-	1
Bridges	2	3	-	7
Dams	1	1	-	2
Runways	2	2	-	3
Water	3	3	1	8
Sewerage	2	4	2	9
Pipelines	1	3	2	5
Other	1	-	-	1

	Contractors Responding Yes to CQC	Contractors Responding No to CQC	Architect/Engineers Responding Yes to CQC	Architect/Engineers Responding No to CQC

D) What is your approximate annual contract award volume?

under $100,000				
$100,000 to $499,999	1	-		
$500,000 to $999,999	-	1		
$1-4.99 Million	5	3	4	7
$5-9.99 Million	2	3	3	6
$10 Million and Greater	4	8	3	14

E) In your type of work do you deal primarily with the: (Contractors only)

Architect/Engineer	-	1
Architect	10	10
Engineer	2	4

APPENDIX F

Question 1: Architect/Engineers and Contractors

Question 1: Contractor and Architect/Engineer Responses

1) What is the frequency in the four areas noted below of the total amount of inspections (excluding municipal building inspections) that you would define as satisfactory. Answer in the job size columns that apply to your company considering the type of work that you do. (Enter frequency: ie, as needed, 1 hr/wk, fulltime, none, etc.)

		Up to $100,000		$100,000 to $500,000		$500,000 to $1Million		$1Million to $3Million		$3Million and Greater	
		Contractor	Architect/ Engineer	Contractor	Architect/ Engineer	Contractor	Architect/ Engineer	Contractor	Architect/ Engineer	Contractor	Architect/ Engineer
Interpretation of the Plans & Specifications	Mean (hr/wk)	1.3	2.7	2.3	4	10.7	6.3	12.5	11.2	22	22.2
	No. Responses for Mean	6	14	7	10	10	13	13	12	16	19
	No. "as Needed" Responses	5	8	6	9	4	8	2	9	5	6
	No. "Fulltime" Responses (1)	-	-	-	1	2	1	3	1	8	8
	Total Responses (2)	12	22	13	19	15	21	15	21	21	26
Quality Control Inspection	Mean (hr/wk)	6.5	11.8	7.5	10.3	16.8	18.6	24.5	25.1	34.9	30.8
	No. Responses for Mean	8	15	9	16	10	16	14	18	18	19
	No. "as Needed" Responses	3	2	5	2	4	2	1	2	-	4

Question 1: Contractor and Architect/Engineer Responses (continued)

		Up to $100,000		$100,000 to $500,000		$500,000 to $1Million		$1Million to $3Million		$3Million and Greater	
		Contractor	Architect/ Engineer	Contractor	Architect/ Engineer	Contractor	Architect/ Engineer	Contractor	Architect/ Engineer	Contractor	Architect/ Engineer
Quality Control Inspection	No. "Fulltime" Responses	1	2	1	1	3	4	7	6	15	9
	Total Responses	12	19	15	18	16	19	17	22	19	24
Job Progress Inspection	Mean (hr/wk)	6.1	7.5	5.8	6.4	8.1	13.9	9	18	23.8	24
	No. Responses for Mean	8	17	11	17	15	19	12	19	15	22
	No. "as Needed" Responses	3	3	2	1	2	2	2	2	1	2
	No. "Fulltime" Responses	1	2	1	1	2	5	1	6	8	10
	Total Responses	11	21	16	19	17	22	14	22	19	24

Note: 1) Fulltime Responses Counted as 40 hr/wk for 1 man.
2) Difference in "No. Responses for Mean" and "Total Responses" consists of unuseable responses such as "As Needed", "Frequently", etc.
3) "Final Acceptance of each stage of work" should have been worded "Final Acceptance of the Job" in the Questionnaire. The responses were inconsistent and therefore they were not used.

Question 1: Contractor and Architect/Engineer Responses According to Question 8 Results

		Up to $100,000				$100,000 to $500,000			
		Contractor Yes to CQC	Contractor No to CQC	A/E Yes to CQC	A/E No to CQC	Contractor Yes to CQC	Contractor No to CQC	A/E Yes to CQC	A/E No to CQC
Interpretation of the Plans & Specifications	Mean (hr/wk)	1.5	1	1.5	3	2.5	2	2.3	4.7
	No. Responses for Mean	4	2	3	11	4	3	3	7
	No. "As Needed" Responses	1	4	2	6	1	5	2	7
	No. "Fulltime" Responses	-	-	-	-	-	-	-	-
	Total Responses	5	7	5	17	5	8	5	14
Quality Control Inspection	Mean (hr/wk)	2.1	13.8	4.4	14.5	3.9	14.7	4.9	12.2
	No. Responses for Mean	5	3	4	11	6	3	4	12
	No. "As Needed" Responses	-	3	1	1	1	4	1	1
	No. "Fulltime" Responses	-	1	-	2	-	1	-	1
	Total Responses	5	7	6	13	7	8	5	13
Job Progress Inspection	Mean (hr/wk)	1.3	14	3.7	9	2.6	11.3	4	7.3
	No. Responses for Mean	5	3	5	12	7	4	5	12
	No. "As Needed" Responses	-	3	-	3	-	2	-	1
	No. "Fulltime" Responses	-	1	-	2	-	1	-	1
	Total Responses	5	6	5	16	10	6	5	14

Question 1: Contractor and Architect/Engineer Responses According to Question 8 Results (continued)

		$500,000 to $1Million				$1Million to $3Million			
		Contractor Yes to CQC	Contractor No to CQC	A/E Yes to CQC	A/E No to CQC	Contractor Yes to CQC	Contractor No to CQC	A/E Yes to CQC	A/E No to CQC
Interpretation of the Plans & Specifications	Mean (hr/wk)	18.2	3.2	2.7	7.4	12.9	12	5.4	14.1
	No. Responses for Mean	5	5	3	10	7	6	4	8
	No. "As Needed" Responses	2	2	3	5	1	1	4	5
	No. "Fulltime" Responses	2	-	-	1	2	1	-	1
	Total Responses	8	7	6	15	8	7	8	13
Quality Control Inspection	Mean (hr/wk)	16.3	17.5	12.5	20.6	24.1	25	10.5	32.5
	No. Responses for Mean	6	4	4	12	8	6	6	12
	No. "As Needed" Responses	1	3	1	1	-	1	1	1
	No. "Fulltime" Responses	2	-	1	3	4	3	1	5
	Total Responses	8	8	6	13	9	8	7	15
Job Progress Inspection	Mean (hr/wk)	7.7	8.7	7.2	16.4	6.5	10.3	17.8	18
	No. Responses for Mean	9	6	5	14	4	8	6	13
	No. "As Needed" Responses	-	2	1	1	-	2	1	1
	No. "Fulltime" Responses	1	1	-	5	-	1	2	4
	Total Responses	9	8	6	16	4	10	8	14

Question 1: Contractor and Architect/Engineer Responses According to Question 8 Results (continued)

		$3Million and Greater			
		Contractor Yes to CQC	Contractor No to CQC	A/E Yes to CQC	A/E No to CQC
Interpretation of the Plans & Specifications	Mean (hr/wk)	18.9	24.3	14.5	24.3
	No. Responses for Mean	7	9	4	15
	No. "As Needed" Responses	2	3	4	2
	No. "Fulltime" Responses	3	5	1	7
	Total Responses	9	12	9	17
Quality Control Inspection	Mean (hr/wk)	33.2	36.7	12	37.6
	No. Responses for Mean	9	9	5	14
	No. "As Needed" Responses	-	-	3	1
	No. "Fulltime" Responses	7	8	-	9
	Total Responses	10	9	9	15
Job Progress Inspection	Mean (hr/wk)	16.9	31.7	18.4	25.7
	No. Responses for Mean	8	7	5	17
	No. "As Needed" Responses	-	1	2	-
	No. "Fulltime" Responses	3	5	1	9
	Total Responses	9	10	7	17

Note: 1) See the notes 1, 2, 3 on the previous table.
2) "Yes to CQC" and "No to CQC" are abbreviations for the respondent's replies to question 8 on the Architect/Engineer and Contractor Questionnaires.

APPENDIX G

Question 2: Architect/Engineers and Contractors

2) Who should perform the inspections mentioned in Question (1)? (Please enter below the appropriate number from the following categories: (1) Architect (part time); (2) Architect ("clerk of the works"); (3) Engineer (part time); (4) Engineer ("clerk of the works"); (5) Contractor; (6) Design Engineer contracted by the Architect; (7) Other (specify_____). (please note if the responsibility should be shared with the appropriate percentages).

Architect/ Engineer Respondents	Interpretation of the Plans and Specifications	Quality Control Inspection	Job Progress Inspection	Final Acceptance of each stage of the work
A/E Responsibility	99	93	98	93
Contractor Responsibility	0	0	0	0
Shared Responsibility: Contractor & A/E	1	1	0	0
Total Responses	100	94	98	93

Architect/Engineer Responses to Question 2

Contractor Respondents				
A/E Responsibility	71	49	59	65
Contractor Responsibility	3	12	7	1
Shared Responsibility: Contractor & A/E	5	16	12	6
Total Responses	79	77	78	72

Contractor Responses to Question 2

	Contractor Responsibility		Shared Responsibility with the A/E & Contractor	
	Yes to CQC	No to CQC	Yes to CQC	No to CQC
Interpretation of the Plans and Specifications	3	-	4	1
Quality Control Inspection	7	5	11	5
Job Progress Inspection	6	1	8	4
Final Acceptance Inspection of each stage of work	1	-	4	2
Total Responses	17	6	27	12

APPENDIX H

Questions 3 - 11: Architect/Engineers and Contractors

The data in this section is presented in tabular form according to the responses of the Architect/Engineers and the Contractors to question 8. In the tables a "Yes" response to question 8 is classified as "Yes to CQC" and a "No" is classified as "No to CQC". The questions on the Architect/Engineer and Contractor Questionnaires are listed in this Appendix according to the question numbers on the Architect/Engineer questionnaire.

3) Do you feel that the Designers that you have worked with have: (check one answer per question)

		Always	Often	Sometimes	Never	Total
a) Had a good regard for inspection						
Architect/Engineer	Yes to CQC	6	1	2		9
	No to CQC	11	12	3		26
Contractor	Yes to CQC	-	7	5	-	12
	No to CQC	3	8	4	-	15
b) Used inspection to get work that is not clearly shown in the Plans and Specifications						
Architect/Engineer	Yes to CQC	-	1	7	1	9
	No to CQC	2	4	16	4	26
Contractor	Yes to CQC	-	7	5	-	12
	No to CQC	-	4	11	-	15
c) Provided satisfactory interpretation of Plans and Specifications						
Architect/Engineer	Yes to CQC	3	6	-	-	9
	No to CQC	9	16	1	-	26
Contractor	Yes to CQC	-	7	5	-	12
	No to CQC	-	10	5	-	15
d) Provided satisfactory Quality Control Inspection						
Architect/Engineer	Yes to CQC	1	4	3		8
	No to CQC	7	11	7		25
Contractor	Yes to CQC	-	5	7		12
	No to CQC	2	7	6		15
e) Provided satisfactory Job Progress Inspection						
Architect/Engineer	Yes to CQC	1	7	2	1	11
	No to CQC	11	10	5	1	27
Contractor	Yes to CQC	-	6	5	-	11
	No to CQC	3	7	4	-	14

		Always	Often	Sometimes	Never	Total
f) Provided satisfactory Final Acceptance Inspection of each stage of the work						
Architect/Engineer	Yes to CQC	-	8	1	-	9
	No to CQC	9	12	4	-	25
Contractor	Yes to CQC	2	3	7	-	12
	No to CQC	3	8	3	1	15
g) Provided satisfactory electrical inspection						
Architect/Engineer	Yes to CQC	-	6	2	1	9
	No to CQC	7	8	9	2	26
Contractor	Yes to CQC	2	2	7	2	13
	No to CQC	2	5	6	1	14
h) Provided satisfactory structural inspection						
Architect/Engineer	Yes to CQC	-	6	2	1	9
	No to CQC	7	10	7	2	26
Contractor	Yes to CQC	1	5	5	1	12
	No to CQC	2	5	5	2	14
i) Provided satisfactory mechanical inspection						
Architect/Engineer	Yes to CQC	1	5	2	1	9
	No to CQC	10	12	2	-	24
Contractor	Yes to CQC	1	5	5	1	12
	No to CQC	2	6	6	-	14

4) Please consider the cost and status of inspection today along with how it has been received by the contractors you have worked with:

a) What percentage of the total contract award price does inspection usually run?_____% (Architect/Engineers only)

	Category	Number of responses used for mean	% of contract award price
Architect/Engineer	a. No to CQC	5	1.8%
	b. Yes to CQC	16	2.3%
	c. Architect/Engineers (a & b)	21	2.2%

b) Do you feel that: (check one answer per question)

		Always	Often	Sometimes	Never	Total
i) Good inspectors are difficult to find						
Architect/Engineer	Yes to CQC	3	7	-	-	10
	No to CQC	8	13	5	-	26
Contractor	Yes to CQC	4	6	2	-	12
	No to CQC	8	4	2	-	14
ii) Inspection is a good tool to ensure that the contractor provides the level of quality specified in the contract						
Architect/Engineer	Yes to CQC	6	4	-	-	10
	No to CQC	22	5	-	-	27
Contractor	Yes to CQC	7	2	3	-	12
	No to CQC	4	6	5	-	15
iii) Inspection is a good tool to help even the best of contractors find mistakes						
Architect/Engineer	Yes to CQC	6	3	1	-	10
	No to CQC	15	8	4	-	27
Contractor	Yes to CQC	8	2	2	-	12
	No to CQC	7	5	2	-	14
iv) The cost of "satisfactory" inspection is too high to provide						
Architect/Engineer	Yes to CQC	-	3	2	5	10
	No to CQC	-	2	4	21	27
Contractor	Yes to CQC	-	3	4	4	11
	No to CQC	-	2	6	7	15
v) Inspection is a service that you like to have on your jobs						
Architect/Engineer	Yes to CQC	9	-	-	1	10
	No to CQC	23	3	1	-	27
Contractor	Yes to CQC	9	2	1	-	12
	No to CQC	10	3	1	-	14
vi) Owners are willing to pay for satisfactory inspection (A/E only)						
Architect/Engineer	Yes to CQC	1	4	5	-	10
	No to CQC	5	14	7	-	26

7. To your knowledge, do contractors in the following categories have a tendency to provide: (check one in each column)

	a) Just Enough Quality Control to get by				b) Level of Quality Control that is required by the Plans/Specifications as interpreted by the Designer				c) Level of Quality Control that is higher than (b) to enhance company reputation				Total Responses			
	Contractor		Architect/ Engineer		Contractor		Architect/ Engineer		Contractor		Architect/ Engineer					
	Yes to CQC	No to CQC	Yes to CQC	No to CQC	Yes to CQC	No to CQC	Yes to CQC	No to CQC	Yes to CQC	No to CQC	Yes to CQC	No to CQC	Contractor Yes to CQC	Contractor No to CQC	A/E Yes to CQC	A/E No to CQC
Up to $100,000 per award	6	4	5	18	1	5	2	2	-	-	-	-	7	9	7	20
Up to $500,000 per award	2	2	5	16	8	4	3	5	-	2	-	-	10	8	8	21
Up to $1Million per award	-	-	3	11	7	6	5	10	2	5	-	-	9	11	8	21
Up to $3Million per award	-	1	2	9	5	5	6	10	3	3	2	4	8	9	10	23
Unlimited per award	-	1	2	8	3	9	6	7	4	5	2	4	7	15	10	19

How often do you (Architect/Engineer) require the contractor to redo work because it is not satisfactory? (check one) ____Never; ____1-5%; ____6-10%; ____11-15%; ____16-20%; ____21% and greater.

Contractor Architect/ Engineer	Never	1-5%	6-10%	11-15%	16-20%	21% & Greater	Total
Yes to CQC	-	3	3	2	-	2	10
No to CQC	-	11	3	5	1	7	27
Yes to CQC	1	8	3	-	-	-	12
No to CQC	2	8	3	1	-	1	15

How often does the contractor on his own initiative require his forces to redo work that is not satisfactory? (check one) ____Never; ____1-5%; ____6-10%; ____11-15%; ____16-20%; ____21% and greater.

Contractor Architect/ Engineer	Never	1-5%	6-10%	11-15%	16-20%	21% & Greater	Total
Yes to CQC	1	6	1	-	-	1	9
No to CQC	2	17	-	2	1	5	27
Yes to CQC	-	6	3	2	1	-	12
No to CQC	-	6	5	2	2	-	15

8) Would you prefer to have the option of a quality of construction clause which has incorporated into it a warranty of construction provision where:

i) the contractor had full responsibility for the inspection services with an extended warranty period, and
ii) the owner/designer had the responsibility for payment, period checks to ensure that the contractor's inspection program is functioning properly, and final acceptance of the completed job? (check one) ____Yes; ____No.

Yes		No	
Contractor	Architect/ Engineer	Contractor	Architect/ Engineer
12	10	15	27

9) If your answer to (8) was YES, please respond to the following questions:

a) What extended warranty period would you consider reasonable? _____Years.

	Contractor	Architect/Engineer
Mean (Years)	1.5	3
No. Responses for Mean	12	10

9 b) Under the contract in question (8) would you like to have the following responsibilities? (check one answer per question).

		Yes	No	Total
i) You could approve your own shop drawings				
	Architect/Engineer	5	5	10
	Contractor	9	3	12
ii) Perform your own Quality Control Inspection				
	Architect/Engineer	6	4	10
	Contractor	11	1	12
iii) Perform your own Final Acceptance Inspection of each stage of the work				
	Architect/Engineer	1	9	10
	Contractor	5	7	12

		Yes	No	Total
iv) Be responsible for the testing under the contract				
	Architect/Engineer	7	3	10
	Contractor	11	1	12
v) Interpretation of the Plans and Specifications by the Designer				
	Architect/Engineer	10	-	10
	Contractor	7	4	11
vi) Submit periodic inspection reports to the Designer				
	Architect/Engineer	9	1	10
	Contractor	11	1	12
vii) Be required to have a Quality Control Branch of your organization to perform (i) thru (vi)				
	Architect/Engineer	6	4	10
	Contractor	6	6	12

10) Do you think that: (check one answer per question)

		Always	Often	Sometimes	Never	Total
a) Satisfactory inspection reduces the cost of construction for the contractor						
Architect/Engineer	Yes to CQC	5	3	2	-	10
	No to CQC	8	10	7	1	26
Contractor	Yes to CQC	4	6	2	-	12
	No to CQC	6	6	2	1	15
b) Owners feel that inspection is important to the quality of the job						
Architect/Engineer	Yes to CQC	6	4	-	-	10
	No to CQC	8	11	6	-	26
Contractor	Yes to CQC	4	6	2	-	12
	No to CQC	5	6	4	-	15
c) Contractors welcome satisfactory inspection						
Architect/Engineer	Yes to CQC	3	4	4	-	11
	No to CQC	7	10	9	1	27

		Always	Often	Sometimes	Never	Total
d) The contractor can have the sole responsibility for inspection and properly inspect a job better than the designer						
Architect/Engineer	Yes to CQC	-	1	1	8	10
	No to CQC	-	-	6	22	28
Contractor	Yes to CQC	-	8	3	1	12
	No to CQC	-	2	11	2	15
e) There would be a conflict of interest if the contractor inspected his own work						
Architect/Engineer	Yes to CQC	2	6	2	1	11
	No to CQC	17	6	1	1	25
Contractor	Yes to CQC	-	-	10	2	12
	No to CQC	3	2	9	1	15
f) Contractor responsibility for inspection lends itself to a Construction Management type of contract						
Architect/Engineer	Yes to CQC	3	5	1	1	10
	No to CQC	3	12	8	1	24
Contractor	Yes to CQC	1	5	4	2	12
	No to CQC	3	7	3	2	15
g) The contractor should be responsible for the quality of his job						
Architect/Engineer	Yes to QCQ	10	-	-	-	10
	No to CQC	22	-	1	2	25
Contractor	Yes to CQC	7	4	1	-	12
	No to CQC	10	2	2	-	14

11) Have you ever had a contract where you had the responsibility for the inspection? ____Yes; ____No; if yes, please explain (ie, Navy - CQC, etc.)

	Architect/Engineer		Contractor	
	Yes to CQC	No to CQC	Yes to CQC	No to CQC
Yes	4	10	12	11
No	6	16	-	4

Yes/No Responses to Question 11

Types of CQC Experience	Architect/Engineer		Contractor	
	Yes to CQC	No to CQC	Yes to CQC	No to CQC
Navy	4	10	7	1
Army	6	16	3	2
Private	-	-	1	5
Cost Plus Negotiated	-	-	-	1
Design Build	-	-	1	-
Government	-	-	1	-
CM	1	-	-	-
Concrete	1	-	-	-

Breakdown of Responses according to types of Contract Experience with CQC

APPENDIX I

Question 12: Architect/Engineer and Contractor

12. Any other comments that you would like to make about inspection and the responsibility for inspection will

The following comments have been selected because they are the most representative of those received. They are presented according to the responses to question 8.

Architect/Engineers who responded "No" to question 8:

1. "The Architect's inspection is the most vital part of client relations. All future work with the client depends on good supervision (at least that is what 15 years have taught us!)"
2. "All our projects are 'inspected' by the contractor, but not to the exclusion of the 'observation of work progress' by our firm of Architect/Engineer/Planners (A/E/P). The position of professional advisor to an Owner places the A/E/P in the middle of the Owner - Contractor Agreement, not as a party to, but as adjudicator. Personally, I prefer to stay in this professional position to avoid potential 'conflict of interest'. The A/E/P should not be doing the contractor's work (inspecting) subs. It's a sad case that the day of real QUALITY WORKMEN seems to be rapidly overtaken by CLOSE ENOUGH quality. Oh, there are some PROUD ENOUGH FEW, but mighty few."
3. "The contractor should never be given the sole responsibility of inspecting his own work."
4. Architect/Engineer inspection is a "system of checks and balances". In that he has a "basically impartial interest for the building project, it is the best insurance for success"!
5. "Inspection to some degree, is an essential part of the check and balance procedure, regardless of the size of the project, remembering that the prime purpose of any business is to show a profit; that bids for construction are highly competitive; that no set of plans and specifications are perfect; nor is the quality of labor and materials furnished beyond question

at any time."

6. The "contractor should be required to test and inspect to the degree necessary to control his own work and satisfy himself that he is meeting contract requirements. Owner's representatives should then work only the necessary 'check' tests".

Architect/Engineers who responded "Yes" to question 8:

1. "This firm has in the past been forced to eliminate inspection from the contract as a method of pseudo economy by the owner. Always, for our own protection, the project receives a certain amount of inspection at no cost to the owner."
2. "Quality control inspection should not be needed if the contractor takes professional pride in his work. Many times, inspection is more important on a 'small' job done by a 'big' contractor. He sometimes goes too fast and overlooks many things. In any type of inspection work, the party being inspected must have performance standards to meet. He really can't do this unless the inspection responsibility is removed from him. He can aid in the inspection work for his mutual benefit, but I don't think he can be solely responsible for it."
3. "I have argued for years that a General Contractor and especially his job superintendent should be required by registration laws to have duly trained and properly qualified (and with evidence of training by exams) persons to run jobs! Our area has a pitifully few <u>good</u> contractors and good personnel. A better system is a must to get better production with fewer qualified men."

Contractors responding "No" to question B:

1. "Inspectors who are experienced and fair (though strict) are always welcomed. The inexperienced junior inspector who can read but not understand is costly to the owner and the contractor. Too often the owner or architect/engineer hire the latter."
2. "In theory CQC is good but not in practice."
3. "We feel that there is a need for better qualified architectural and engineering inspectors along with a better line of communications and working relationships with general contractors. At the present, we feel there is a great lack of qualified inspectors, since many are not experienced in actual field work. It seems to us that a program needs developing that would attempt to form a team of the architect, contractor, and engineer, rather than them acting as police. Much of this could be accomplished by incorporating; within the requirements of universities and colleges teaching allied subject, certain cooperative courses to better ascertain the problems of both as related to inspection and quality control."
4. "On all jobs the contractor should be able to call on the Architect and Engineers when needed, and they should make periodic inspections. The contractor quality control program has one major flaw; that is, it relieves the inspection agency of all responsibilities."
5. In the program outlined in question 8 the answer is "No" "as apparently in this area the responsibilities are already covered by the General Contractor, it would serve only to

extend the warranty period which is generally abused as is."

6. "Every contractor should be interested and take enough pride in his job to put out the best always. More often than not he is interested in 'getting by'. We prefer not to do our inspection for the records. If the owner feels he needs inspection he should hire. Even though the contractor is retained by the owner an independent testing company hired by the owner can give him more peace of mind than if he thinks the contractor is 'tampering' with the inspector. Owners often feel that the General Contractor who inspects his own work is trying to put one over on them."
7. "We believe that an inspector is pretty useless unless he has authority and ability to reconcile discrepancies in the specs, fill in deficiencies, and revise details to eliminate unworkable ones, all in agreement with its contractor. Many inspectors have never been indoctrinated to fulfill a middle position between the owner and the contractor. Most inexperienced inspectors lean far toward representing only the owner instead of a middle position. Most inspectors are overly defensive of the designer's omnipotence."

Contractors responding "Yes" to question 8:

1. "We have a quality Control Branch, but we feel that they should not try to interpret plans and specifications. In most cases they would be called upon to 'read the mind' of an Architect or Engineer, which is a very hazardous obligation. Our quality

control work more than pays for itself in that it helps 'interface' each activity one with the other, thereby speeding up the job. This is especially true in our CM Division for 'system' jobs."

2. "Quality control properly done will make jobs move faster and be accepted sooner."

APPENDIX J

Summary of Navy Related Responses to Questions A thru E

Information: Position
Annual Contract Award Volume
CQC Experience
Company Classification

Note: 1) The data in this section and in following sections is presented in tabular form according to the responses to question 11:

Would you prefer to return to the Navy Construction Inspection System and delete the CQC provisions from the contract? ____Yes; ____No.

In the tables a "Yes" response is classified as "Delete CQC" and a "No" response is classified as "Retain CQC".

2) A "CQC Contractor" is a contractor who was sent a Navy CQC questionnaire because of his previous CQC experience.

A) What is your position in your organization? (check one)

	Navy Personnel Delete CQC	Navy Personnel Retain CQC	TOTAL	CQC Contractor Delete CQC	CQC Contractor Retain CQC	TOTAL	CQC Representative Delete CQC	CQC Representative Retain CQC	TOTAL
ROICC	3	8	11						
AROICC	10	11	21						
Inspector/Construction Representative	7	4	11						
Quality Assurance Engineer	2	1	3						
Director Construction Division		1	1						
Supervisory Construction Engineer	6	1	7						
CQC Representative							2	9	11
President				7	6	14			
Vice President				4	5	9			
Project Manager					4	4			
Chairman of the Board					1	1			
Director of Business Development					1	1			
Chief Engineer					1	1			
Engineer Superintendent					1	1			
Construction Engineering Technician								1	1
TOTAL	28	26	54	11	19	30	2	10	12

B) What is your rank (Military or civil service)? (Navy Personnel only). (CQC Contractors only)

	Navy Personnel Delete CQC	Navy Personnel Retain CQC	TOTAL
Ensign	2	2	4
Lt. (jg)	5	1	6
Lieutenant	2	5	7
Lt. Commander	2	8	10
Commander	1	2	3
Captain	-	1	1
Civil Servant	2	1	3
GS-9	4	1	5
GS-11	2	1	3
GS-12	7	2	9
GS-13	1	1	2
GS-15	-	1	1
TOTAL	28	26	54

B) How would you classify your business? (check one) (CQC Contractors only)

General Contractor	10	13	23
Specialty Contractor	-	3	3
Electrical Contractor	1	-	1
Heavy Contractor	-	2	2
Heavy Mechanical Contractor	-	1	1
TOTAL	11	19	30

	CQC Contractor Delete CQC	CQC Contractor Retain CQC

C) What is your approximate annual contract award volume? (check one) (CQC Contractors only)

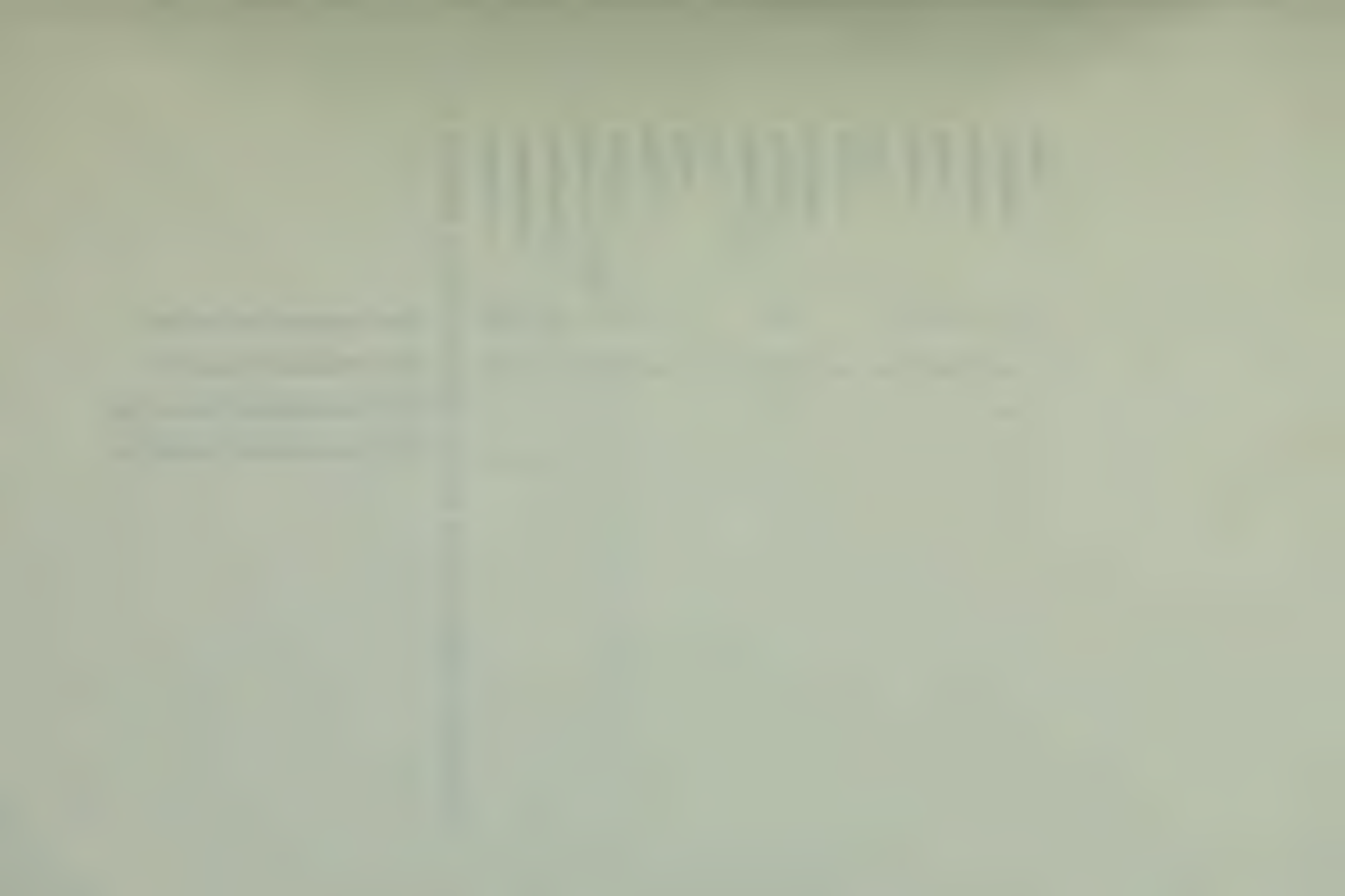
$500,000 - 999,999	1	-
$1Million - 4.99Million	4	6
$5Million - 9.99Million	2	5
$10Million and Greater	4	8

D) Primary type(s) of CQC work that your company has performed for the Navy (check as appropriate): (CQC Contractors only)

Commercial	5	7
Industrial	9	8
Residential	5	2
Other Buildings	2	6
Religious		1
Health	1	2
Hangar		1
Pier		1
Utilities		4
Highways		1
Tunnels		1
Runways		1
Water		1
Pipelines		1

D) How many CQC Contracts have you had in the following categories?

	Navy Personnel Delete CQC	Navy Personnel Retain CQC	CQC Representative Delete CQC	CQC Representative Retain CQC
Commercial	32	20	2	1
Industrial	17	102		7
Residential	16	31	1	2
Other Buildings	8	61		1
BOQ/BEQ	11	27	4	5
Health	3	6		2
Hangar	1	6		
Pier		7		
Dining Hall		5		
Education	18	11	2	2
Utilities		1		
Highways		7		
Dams		1		
Runways	11	12		1
Water	1	4		
Sewerage	5	8		1
Pipelines		4	1	
Other	8			



E) How many CQC contracts have you had in the following contract ranges: (enter the number, i.e., 1, 2, 3, etc. where appropriate).

	Navy Personnel Delete CQC	Navy Personnel Retain CQC	CQC Representative Delete CQC	CQC Representative Retain CQC
Navy Personnel and CQC Representatives				
$100,000 - 499,999	41	71		1
$500,000 - 999,999	43	114		3
$1Million - 4.99Million	82	158	7	15
$5Million - 9.99Million	14	49		2
$10Million and Greater	4	13	2	3

	CQC Contractor Delete CQC	CQC Contractor Retain CQC
Contractor		
up to $100,000		
$100,000 - 500,000	2	4
$500,000 - 1Million	6	7
$1Million - 3Million	8	23
$3Million and Greater	2	

APPENDIX K

Question 1: Navy Related Respondents

Question 1: Navy Related Respondents

1) What is the frequency of the total amount of inspection on Navy CQC contracts in the four areas noted below that you would consider as being "satisfactory". Consider the type and size of contracts that you do and respond in the applicable contract range given: (enter frequency: i.e., 1 hr/wk, fulltime, as needed, none, etc.)

		Up to $100,000			$100,000 to $500,000		
		Navy	CQC Contractor	CQC Representative	Navy	CQC Contractor	CQC Representative
Interpretation of the Plans & Specifications	Mean (hr/wk)	4.1	4	6	8.2	33	5
	No. Responses for Mean	14	3	2	18	4	1
	No. as Needed Responses	14	4	-	14	4	-
	No. Fulltime Responses (1)	-	-	-	1	3	-
	Total Responses (2)	28	7	2	32	9	1
Quality Control Inspection	Mean (hr/wk)	18	3	6	22.6	26.3	10
	No. Responses for Mean	24	4	1	28	7	1
	No. as Needed Responses	3	1	-	3	1	-
	No. Fulltime Responses	8	-	-	10	4	-
	Total Responses	27	6	1	31	9	1
Job Progress Inspection	Mean (hr/wk)	4.4	2.1	.5	8.3	13.1	1
	No. Responses for Mean	19	6	1	23	7	1
	No. as Needed Responses	5	1	-	5	2	-
	No. Fulltime Responses	-	-	-	2	2	-
	Total Responses	26	7	1	29	9	1

Question 1: Navy Related Respondents (continued)

		$500,000 to $1Million			$1Million to $3Million		
		Navy	CQC Contractor	CQC Representative	Navy	CQC Contractor	CQC Representative
Interpretation of the Plans & Specifications	Mean (hr/wk)	10.6	10.7	15	14.7	19.1	19.3
	No. Responses for Mean	22	10	1	24	15	7
	No. as Needed Responses	15	3	-	18	6	2
	No. Fulltime Responses (1)	2	2	-	3	5	2
	Total Responses (2)	37	13	1	44	21	9
Quality Control Inspection	Mean (hr/wk)	29.4	23	15	33.4	27.3	29.3
	No. Responses for Mean	35	11	1	47	16	6
	No. as Needed Responses	1	1	-	1	3	1
	No. Fulltime Responses	19	6	-	35	10	3
	Total Responses	36	13	1	48	21	8
Job Progress Inspection	Mean (hr/wk)	9.8	9.8	1	16.9	11.9	10.5
	No. Responses for Mean	22	11	1	38	17	6
	No. as Needed Responses	6	1	-	4	2	1
	No. Fulltime Responses	1	2	-	12	4	1
	Total Responses	28	13	1	43	20	7

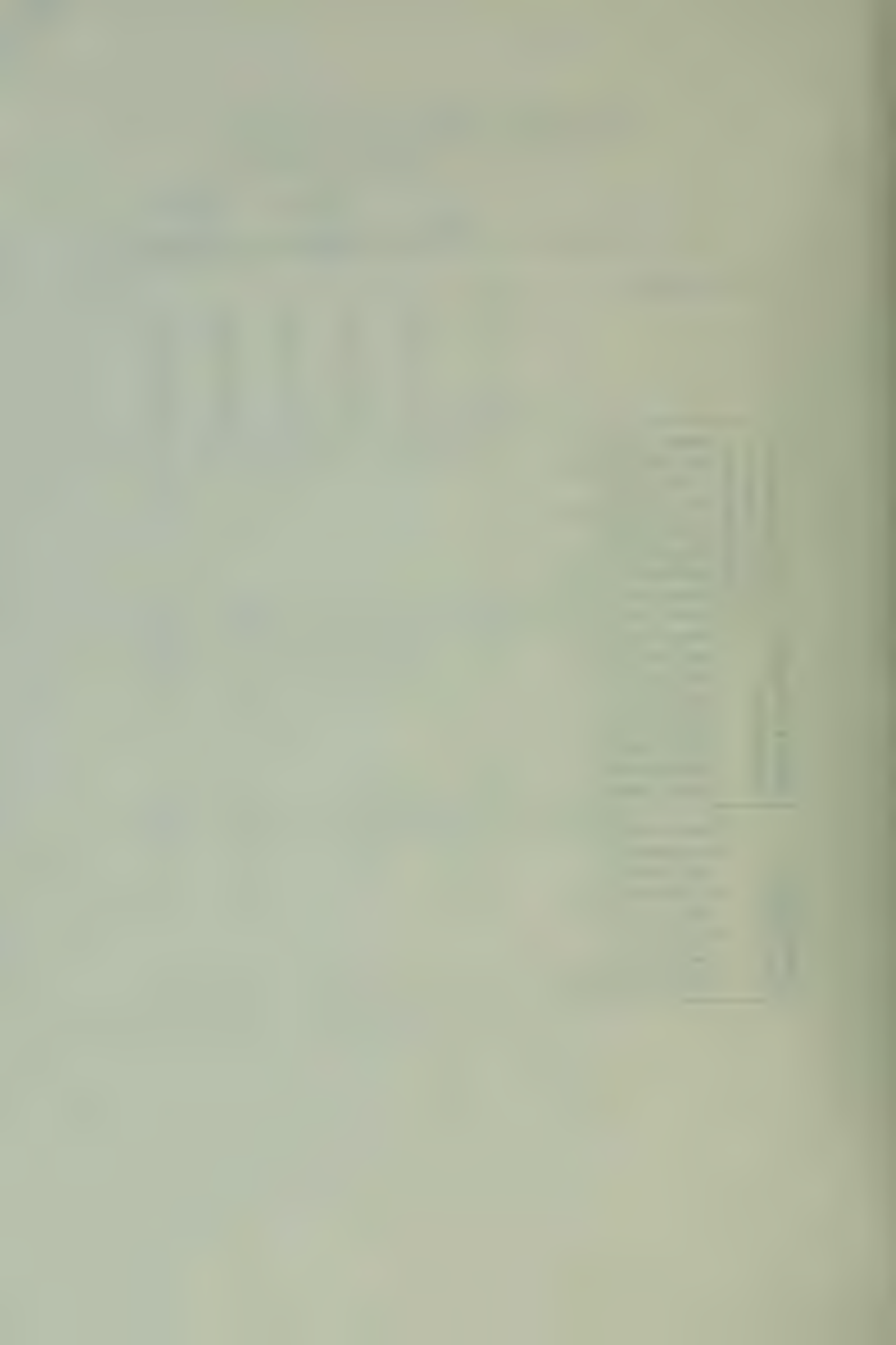
Question 1: Navy Related Respondents (continued)

		$3Million and Greater		
		Navy	CQC Contractor	CQC Representative
Interpretation of the Plans & Specifications	Mean (hr/wk)	19.2	31.6	29.2
	No. Responses for Mean	24	7	3
	No. as Needed Responses	12	5	-
	No. Fulltime Responses(1)	7	5	1
	Total Responses(2)	37	14	3
Quality Control Inspection	Mean (hr/wk)	42.6	29.1	36.3
	No. Responses for Mean	38	10	4
	No. as Needed Responses	-	2	-
	No. Fulltime Responses	31	6	3
	Total Responses	38	14	4
Job Progress Inspection	Mean (hr/wk)	24.1	18	40
	No. Responses for Mean	30	10	1
	No. as Needed Responses	3	2	1
	No. Fulltime Responses	13	3	1
	Total Responses	34	14	3

Note: 1) Fulltime responses counted as 40 hr/wk for 1 man.
2) Difference in "No. Responses for Mean" and "Total Responses" consists of unuseable responses such as "as needed", "frequently" etc.
3) "Final Acceptance of each stage of the work" should have been worded as "Final Acceptance of the job" on the questionnaire. The responses were inconsistent and, therefore, they were not used.

Question 1: Navy Personnel Responses
According to Question 11 Replies

Navy Personnel		Up to $100,000		$100,000 to $500,000		$500,000 to $1Million	
		Delete CQC(1)	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC
Interpretation of the Plans & Specifications	Mean (hr/wk)	3.5	4.5	8.2	8.2	8.8	11.7
	No. Responses for Mean	6	8	6	12	8	14
	No. as Needed Responses	5	9	8	6	9	6
	No. Fulltime Responses (1)	-	-	-	1	-	2
	Total Responses (1)	11	17	14	18	17	20
Quality Control Inspection	Mean (hr/wk)	27	12.5	26.4	19.3	32.1	26.9
	No. Responses for Mean	9	15	13	15	17	18
	No. as Needed Responses	1	2	1	2	-	1
	No. Fulltime Responses	5	3	6	4	11	8
	Total Responses	10	17	14	17	17	19
Job Progress Inspection	Mean (hr/wk)	4.9	4.2	9.2	7.7	12	6.6
	No. Responses for Mean	7	12	10	13	13	9
	No. as Needed Responses	2	3	2	3	2	4
	No. Fulltime Responses	-	-	-	2	1	-
	Total Responses	10	16	13	16	15	13



Question 1: Navy Personnel Responses According to Question 11 Replies (continued)

		$1Million to $3Million		$3Million and Greater	
		Delete CQC	Retain CQC	Delete CQC	Retain CQC
Interpretation of the Plans & Specifications	Mean (hr/wk)	9.5	19	18.9	19.4
	No. Responses for Mean	11	13	8	16
	No. as Needed Responses	13	5	8	4
	No. Fulltime Responses (1)	-	3	1	6
	Total Responses	24	20	16	21
Quality Control Inspection	Mean (hr/wk)	33.2	33.5	45	40.8
	No. Responses for Mean	25	22	16	22
	No. as Needed Responses	-	1	-	-
	No. Fulltime Responses	19	16	15	16
	Total Responses	25	23	16	22
Job Progress Inspection	Mean (hr/wk)	14.9	19.5	25.1	23.3
	No. Responses for Mean	22	16	14	16
	No. as Needed Responses	-	4	-	3
	No. Fulltime Responses	6	6	7	6
	Total Responses	22	21	14	20

Note: 1) See notes 1, 2, 3 on the previous table
2) The data in this table and in the following two tables is presented according to the responses to question 11. A "Yes" response is classified as "Delete CQC" and a "No" response is classified as "Retain CQC".

Question 1: CQC Contractor Responses
According to Question 11 Replies

	Contractors who had had CQC work and were sent CQC Questionnaires	Up to $100,000		$100,000 to $500,000		$500,000 to $1Million	
		Delete CQC[1]	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC
Interpretation of the Plans & Specifications	Mean (hr/wk)	2	5	22	44	13.5	10.6
	No. Responses for Mean	1	2	2	2	5	5
	No. as Needed Responses	1	3	1	3	1	2
	No. Fulltime Responses[1]	-	-	1	2	1	1
	Total Responses[1]	2	5	3	6	6	7
Quality Control Inspection	Mean (hr/wk)	3	3	21	28.4	21.5	24.8
	No. Responses for Mean	2	2	2	5	6	5
	No. as Needed Responses	-	1	-	1	-	1
	No. Fulltime Responses	-	-	1	3	3	3
	Total Responses	2	4	2	7	6	7
Job Progress Inspection	Mean (hr/wk)	.75	2.8	1.5	18.4	8.9	10.8
	No. Responses for Mean	2	4	2	5	6	5
	No. as Needed Responses	-	1	1	1	-	1
	No. Fulltime Responses	-	-	-	2	1	1
	Total Responses	2	5	3	6	6	7

Question 1: CQC Contractor Responses According to Question 11 Replies (continued)

		$1Million to $3Million		$3Million and Greater	
		Delete CQC	Retain CQC	Delete CQC	Retain CQC
Interpretation of the Plans & Specifications	Mean (hr/wk)	18.2	19.5	20.3	40
	No. Responses for Mean	5	10	3	4
	No. as Needed Responses	-	6	2	3
	No. Fulltime Responses(1)	1	4	1	4
	Total Responses(1)	5	16	6	8
Quality Control Inspection	Mean (hr/wk)	28.3	27.1	19.5	35.4
	No. Responses for Mean	3	13	4	6
	No. as Needed Responses	2	1	2	-
	No. Fulltime Responses	2	8	1	5
	Total Responses	5	16	6	8
Job Progress Inspection	Mean (hr/wk)	5.6	14.5	13.8	22.1
	No. Responses for Mean	5	12	5	5
	No. as Needed Responses	-	2	1	1
	No. Fulltime Responses	1	3	1	2
	Total Responses	5	15	6	8

Note: 1) See notes 1 and 2 on the previous table.

Question 1: CQC Representative Responses
According to Question 11 Replies

	CQC Representative	Up to $100,000		$100,000 to $500,000		$500,000 to $1Million	
		Delete CQC[1]	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC
Interpretation of the Plans & Specifications	Mean (hr/wk)	10	2	-	5	-	15
	No. Responses for Mean	1	1	-	1	-	1
	No. as Needed Responses	-	-	-	-	-	-
	No. Fulltime Responses[1]	-	-	-	-	-	-
	Total Responses[1]	1	1	-	1	-	1
Quality Control Inspection	Mean (hr/wk)	6	-	-	10	-	15
	No. Responses for Mean	1	-	-	1	-	1
	No. as Needed Responses	-	-	-	-	-	-
	No. Fulltime Responses	-	-	-	-	-	-
	Total Responses	1	-	-	1	-	1
Job Progress Inspection	Mean (hr/wk)	.5	-	-	1	-	1
	No. Responses for Mean	1	-	-	1	-	1
	No. as Needed Responses	-	-	-	-	-	-
	No. Fulltime Responses	-	-	-	-	-	-
	Total Responses	1	-	-	1	-	1

Question 1: CQC Representative Responses According to Question 11 Replies (continued)

		$1Million to $3Million		$3Million and Greater	
		Delete CQC	Retain CQC	Delete CQC	Retain CQC
Interpretation of the Plans & Specifications	Mean (hr/wk)	8	21.2	-	29.2
	No. Responses for Mean	1	6	-	3
	No. as Needed Responses	-	2	-	-
	No. Fulltime Responses (1)	-	2	-	1
	Total Responses (1)	1	8	-	3
Quality Control Inspection	Mean (hr/wk)	16	32	-	36.3
	No. Responses for Mean	1	5	-	4
	No. as Needed Responses	-	1	-	-
	No. Fulltime Responses	-	3	-	3
	Total Responses	1	7	-	4
Job Progress Inspection	Mean (hr/wk)	5	11.4	-	40
	No. Responses for Mean	1	5	-	1
	No. as Needed Responses	-	1	-	1
	No. Fulltime Responses	-	1	-	1
	Total Responses	1	6	-	3

Note: 1) See note 1 on the previous table

APPENDIX L

Question 2: Navy Related Respondents

Question 2: Navy Related Respondents

2) Who do you think should perform the inspection mentioned in Question (1)? (Please enter below the appropriate number from the following categories: (1) Navy (part time); (2) Navy ("clerk of the works"); (3) Contractor (part time); (4) Contractor ("clerk of the works"/CQC Representative); (5) Design Architect/Engineer (part time); (6) Design Architect/Engineer ("clerk of the works"); (7) Other (specify_____). Please note if the responsibility should be shared with the appropriate percentages).

		Interpretation of the Plans and Specifications	Quality Control Inspection	Job Progress Inspection	Final Acceptance of each stage of the work
Navy Personnel	Navy	42	33	49	60
	Contractor	3	56	10	10
	Shared: Navy/Contractor/Design Architect/Engineer	90	92	114	93
	Shared: Navy & Design Architect/Engineer	40	1	3	12
	Design Architect/ Engineer	2	6	-	2
	Total Responses	177	188	176	177
CQC Contractor	Navy	11	12	10	22
	Contractor	6	28	17	8
	Shared: Navy/Contractor/Design Architect/Engineer	29	14	26	20
	Shared: Navy Design Architect/Engineer	4	-	3	4
	Design Architect/ Engineer	12	10	8	7
	Total Responses	62	64	64	61

Question 2: Navy Related Respondents (continued)

CQC Representative	Interpretation of the Plans and Specifications	Quality Control Inspection	Job Progress Inspection	Final Acceptance of each stage of the work
Navy	2	1	3	4
Contractor	4	12	7	4
Shared: Navy/Contractor/Design Architect/Engineer	5	4	6	8
Shared: Navy/Design Architect/Engineer	-	-	-	-
Design Architect/Engineer	6	1	1	1
Total Responses	17	18	17	17

Question 2: Navy Related Responses According to Question 11 Replies

		Interpretation of the Plans and Specifications		Quality Control Inspection		Job Progress Inspection		Final Acceptance of each stage of the work	
		Delete CQC[1]	Retain CQC[1]	Delete CQC	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC
Navy Personnel	Navy	24	18	23	10	30	19	35	25
	Contractor	3	0	21	35	2	8	7	3
	Shared: Navy/Contractor/Design Architect/Engineer	38	52	33	59	44	70	31	62
	Shared: Navy/Design Architect/Engineer	19	21	1	-	2	1	5	7
	Design Architect/Engineer	2	0	6	-	-	-	2	-
	Total Responses	86	91	84	104	78	98	80	97
CQC Contractor	Navy	8	3	10	2	8	2	14	8
	Contractor	2	4	5	23	5	12	-	8
	Shared: Navy/Contractor/Design Architect/Engineer	5	24	4	10	6	20	5	15
	Shared: Navy/Design Architect/Engineer	-	4	-	-	-	3	1	3
	Design Architect/Engineer	8	4	5	5	5	3	5	2
	Total Responses	23	39	24	40	24	40	25	36

Question 2: Navy Related Responses According to Question 11 Replies (continued)

CQC Representative	Interpretation of the Plans and Specifications		Quality Control Inspection		Job Progress Inspection		Final Acceptance of each stage of the work	
	Delete CQC[1]	Retain CQC[1]	Delete CQC	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC
Navy	-	2	-	1	-	3	-	4
Contractor	1	3	-	12	-	7	-	4
Shared: Navy/Contractor/Design Architect/Engineer	-	5	1	3	-	6	1	7
Shared: Navy/Design Architect/Engineer	-	-	-	-	-	-	-	-
Design Architect/Engineer	-	6	-	1	-	1	-	1
Total Responses	1	16	1	17	-	17	1	16

Note: 1) The data in this table and in the following tables is presented according to the responses to question 11. A "Yes" response is classified as "Delete CQC" and a "No" response is classified as "Retain CQC".

Table of Shared Percentages for Question 2: Contractor and Navy Personnel

		Interpretation of the Plans and Specifications		Quality Control Inspection		Job Progress Inspection		Final Acceptance of each stage of the work	
		Delete CQC[2]	Retain CQC[2]	Delete CQC	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC
Navy Personnel	Mean: Navy/Contractor[1]	43/57	51/49	27/73	25/75	47/53	34/66	37/63	42/58
	No. Responses for Mean	13	17	25	43	27	41	23	33
	Mean: Contractor/Design Architect/Engineer[1]	20/80	-	-	-	-	-	-	-
	No. Responses for Mean	1	-	-	-	-	-	-	-
	Mean: Navy/Contractor/ Design Architect/ Engineer[1]	19/53/28	17/75/8	20/50/30	15/75/10	20/52/28	65/25/10	-	35/58/7
	No. Responses for Mean	11	19	1	1	2	2	-	3
Contractor (CQC)	Mean: Navy/Contractor[1]	50/50	50/50	-	70/30	42/58	50/50	37/63	45/55
	No. Responses for Mean	2	6	-	3	5	8	5	7
	Mean: Contractor/Design Architect/Engineer[1]	-	-	80/20	-	50/50	50/50	-	-
	No. Responses for Mean	-	-	2	-	1	4	-	-
	Mean: Navy/Contractor Design Architect/ Engineer[1]	-	36/33/31	15/79/6	10/80/10	-	-	30/40/30	50/40/10
	No. Responses for Mean	-	11	1	1	-	-	2	1

Note: 1) All mean values expressed as percentages.
2) See note 1 on the previous page.

APPENDIX M

Question 3 - 11: Navy Related Respondents

Note: 1) The data in this section is presented in tabular form according to the responses to question 11. In the tables a "Yes" response is classified as "Delete CQC" and a "No" response is classified as "Retain CQC".

2) A "CQC Contractor" is a contractor who was sent a Navy questionnaire because of his previous CQC experience.

3) Do you feel that the Navy ROICC office that you have worked with on CQC jobs have: (check one answer per question)

		Always	Often	Sometimes	Never	Total
a) Had a good regard for inspection						
Navy	Delete CQC	14	10	3	-	27
	Retain CQC	9	15	-	-	24
CQC Contractor	Delete CQC	3	4	3	1	11
	Retain CQC	9	5	3	1	18
CQC Representative	Delete CQC	1	-	1	-	2
	Retain CQC	4	3	3	1	11
b) Used inspection to get work that is not clearly shown in the Plans and Specifications						
Navy	Delete CQC	1	5	17	4	27
	Retain CQC	1	4	13	5	23
CQC Contractor	Delete CQC	2	-	7	2	11
	Retain CQC	1	1	10	7	19
CQC Representative	Delete CQC	2	-	-	-	2
	Retain CQC	1	2	5	2	10
c) Provided satisfactory interpretation of Plans and Specifications						
Navy	Delete CQC	5	21	1	-	27
	Retain CQC	2	19	3	-	24
CQC Contractor	Delete CQC	2	7	1	1	11
	Retain CQC	5	8	5	1	19
CQC Representative	Delete CQC	1	-	1	-	2
	Retain CQC	1	5	4	1	11
d) Provided satisfactory Final Acceptance Inspection of the completed job (CQC contractor only)						
CQC Contractor	Delete CQC	4	5	2	-	11
	Retain CQC	8	7	2	1	18
e) Provided satisfactory surveillance/inspection of your CQC program						
Navy	Delete CQC	5	14	8	-	27
	Retain CQC	4	16	4	-	24

		Always	Often	Sometimes	Never	Total
CQC Contractor	Delete CQC	3	4	4	-	10
	Retain CQC	7	8	4	-	19
CQC Representative	Delete CQC	1	-	1	-	2
	Retain CQC	2	5	3	1	11

f) Had a good regard for the CQC Program

Navy	Delete CQC	1	2	19	5	27
	Retain CQC	3	11	10	1	25
CQC Contractor	Delete CQC	1	3	4	2	10
	Retain CQC	8	6	4	1	19
CQC Representative	Delete CQC	-	1	1	-	2
	Retain CQC	4	1	4	2	11

4) Do you feel that: (check one answer per question)

a) Inspection is a good tool to ensure that the contractor provides the level of quality specified in the contract

Navy	Delete CQC	19	7	2	-	28
	Retain CQC	21	5	-	-	26
CQC Contractor	Delete CQC	7	2	2	-	11
	Retain CQC	12	4	3	-	20
CQC Representative	Delete CQC	1	-	-	1	2
	Retain CQC	3	4	3	-	10

b) Inspection is a good tool to help even the best of contractors find mistakes

Navy	Delete CQC	15	11	2	-	28
	Retain CQC	13	8	5	-	26
CQC Contractor	Delete CQC	8	1	2	-	11
	Retain CQC	12	5	2	-	19
CQC Representative	Delete CQC	1	-	-	-	1
	Retain CQC	4	4	2	-	10

c) Inspection is a service that you like to have on your job

Navy	Delete CQC	22	4	-	-	26
	Retain CQC	23	3	-	-	26

		Always	Often	Sometimes	Never	Total
CQC Contractor	Delete CQC	10	2	-	-	12
	Retain CQC	12	4	2	-	18
CQC Representative	Delete CQC	2	-	-	-	2
	Retain CQC	3	3	3	-	9
d) The cost of a "satisfactory" CQC program is too expensive too provide						
Navy	Delete CQC	4	12	8	4	28
	Retain CQC	1	1	14	10	26
CQC Contractor	Delete CQC	-	6	4	-	10
	Retain CQC	-	3	8	7	18
CQC Representative	Delete CQC	-	1	-	1	2
	Retain CQC	1	-	7	1	9
e) The contractor should be responsible for the quality of his job						
Navy	Delete CQC	24	1	3	-	28
	Retain CQC	25	-	1	-	26
CQC Contractor	Delete CQC	8	3	-	-	11
	Retain CQC	17	2	-	-	19
CQC Representative	Delete CQC	2	-	-	-	2
	Retain CQC	9	-	-	-	9
f) Good CQC representatives are difficult to find						
Navy	Delete CQC	14	11	3	-	28
	Retain CQC	5	16	4	1	26
CQC Contractor	Delete CQC	8	2	2	-	12
	Retain CQC	5	6	6	1	18
CQC Representative	Delete CQC	-	2	-	-	2
	Retain CQC	2	5	2	-	9
g) CQC increases job productivity						
Navy	Delete CQC	1	5	15	7	28
	Retain CQC	-	9	14	3	26
CQC Contractor*	Delete CQC	-	1	7	3	11
	Retain CQC	3	7	9	-	19
CQC Representative	Delete CQC	-	-	1	1	2
	Retain CQC	4	2	3	-	9

*The CQC contractor was asked if "CQC insures job productivity"

		Always	Often	Sometimes	Never	Total
h) CQC reduces submitted approval time						
Navy	Delete CQC	2	10	14	2	28
	Retain CQC	8	11	7	-	26
CQC Contractor	Delete CQC	1	3	5	2	11
	Retain CQC	9	6	3	1	19
CQC Representative	Delete CQC	-	1	-	1	2
	Retain CQC	5	3	1	-	9
i) CQC gets the job off to a smoother start						
Navy	Delete CQC	6	10	8	3	27
	Retain CQC	8	14	3	1	26
CQC Contractor	Delete CQC	1	5	3	2	11
	Retain CQC	6	10	3	-	19
CQC Representative	Delete CQC	1	-	-	1	2
	Retain CQC	4	3	2	-	9
j) CQC gives the contractor more freedom in controlling his own operations						
Navy	Delete CQC	6	10	8	3	27
	Retain CQC	8	14	3	1	26
CQC Contractor	Delete CQC	1	5	3	2	11
	Retain CQC	6	10	3	-	19
CQC Representative	Delete CQC	1	-	-	1	2
	Retain CQC	4	3	2	-	9
k) CQC helps the contractor to recognize construction problems and solutions earlier						
Navy	Delete CQC	1	6	17	2	26
	Retain CQC	4	16	5	1	26
CQC Contractor	Delete CQC	-	4	5	2	11
	Retain CQC	5	9	5	-	19
CQC Representative	Delete CQC	-	1	1	-	2
	Retain CQC	3	4	2	-	9

		Always	Often	Sometimes	Never	Total
1) Inspection by the contractor gives the Navy a better completed job than under the old Navy Construction Inspection System						
Navy	Delete CQC	-	1	8	17	26
	Retain CQC	1	7	15	3	26
CQC Contractor	Delete CQC	-	2	7	2	11
	Retain CQC	5	8	6	-	19
CQC Representative	Delete CQC	-	-	1	-	1
	Retain CQC	2	3	3	-	8

			Always	Often	Sometimes	Never	Total
m) There is a conflict of interest because the contractor is inspecting his own work							
	Navy	Delete CQC	15	10	2	1	28
		Retain CQC	5	2	16	3	26
	CQC Contractor	Delete CQC	2	2	6	1	11
		Retain CQC	-	1	14	4	19
	CQC Representative	Delete CQC	-	1	-	1	2
		Retain CQC	-	-	8	1	9
n) Contractor inspection lends itself to a Construction Management type of contract							
	Navy	Delete CQC	7	12	7	1	27
		Retain CQC	1	7	12	4	24
	CQC Contractor	Delete CQC	1	6	3	-	10
		Retain CQC	4	5	6	4	19
	CQC Representative	Delete CQC	-	2	-	-	2
		Retain CQC	3	2	2	1	8

6) How often do you (ROICC personnel) require the contractor to redo work, because it is not satisfactory? (check one)
____Never; ____1-5%; ____6-10%; ____11-15%; ____16-20%; ____21% and greater.

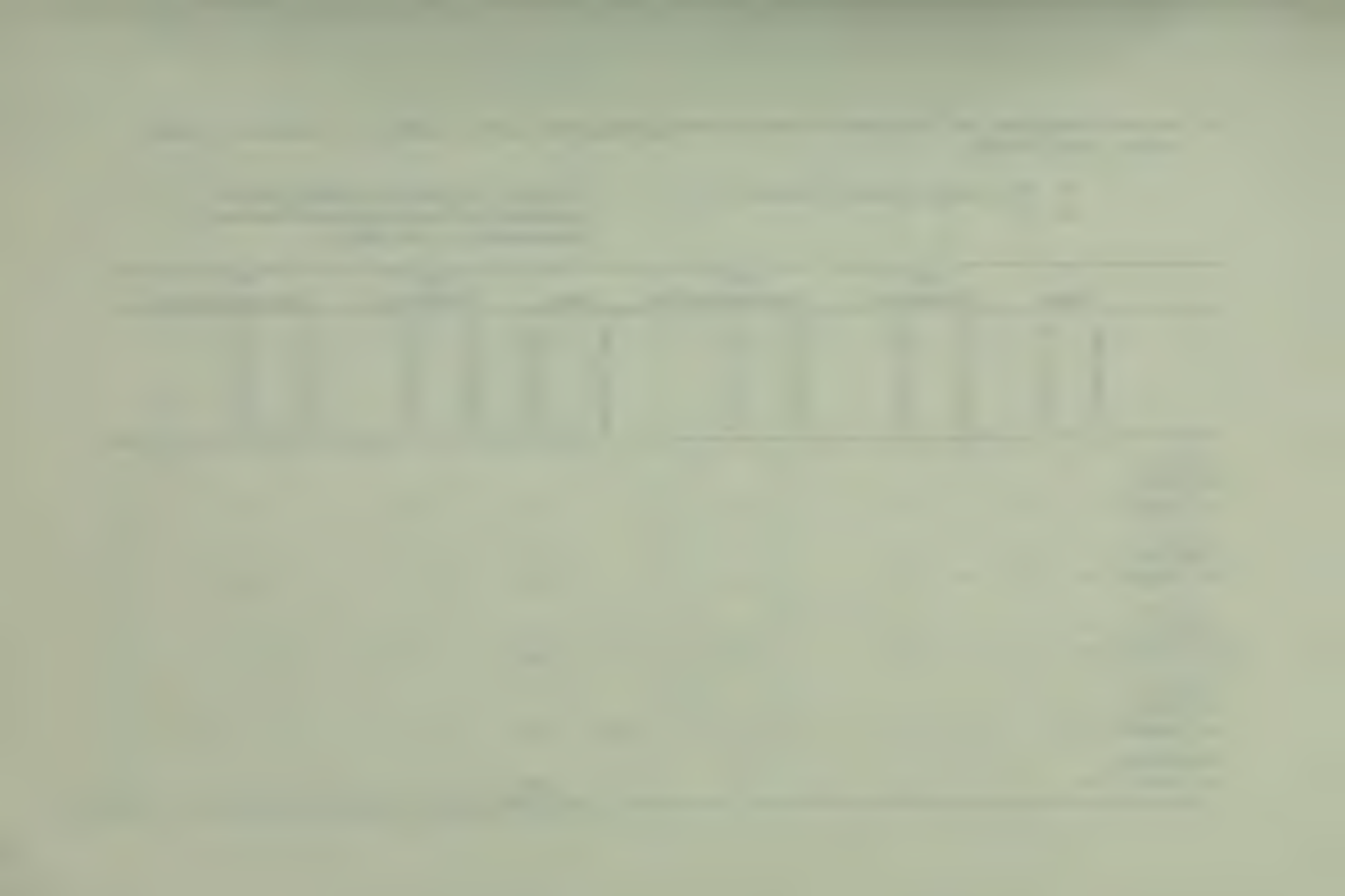
		Never	1-5%	6-10%	11-15%	16-20%	21% & Greater	Total
CQC Representative - CQC Contractor - Navy								
	Delete CQC	-	14	10	2	1	1	28
	Retain CQC	1	13	7	2	-	2	25
	Delete CQC	-	8	1	-	-	2	11
	Retain CQC	2	14	1	-	-	-	17
	Delete CQC	-	2	-	-	-	-	2
	Retain CQC	-	6	3	-	-	-	9

5) To your knowledge, do contractor in the following categories have a tendency to provide: (check one in each column).

a) Just enough Quality Control to get by

b) Level of Quality Control that is required by Plans and Specifications interpreted by the ROICC

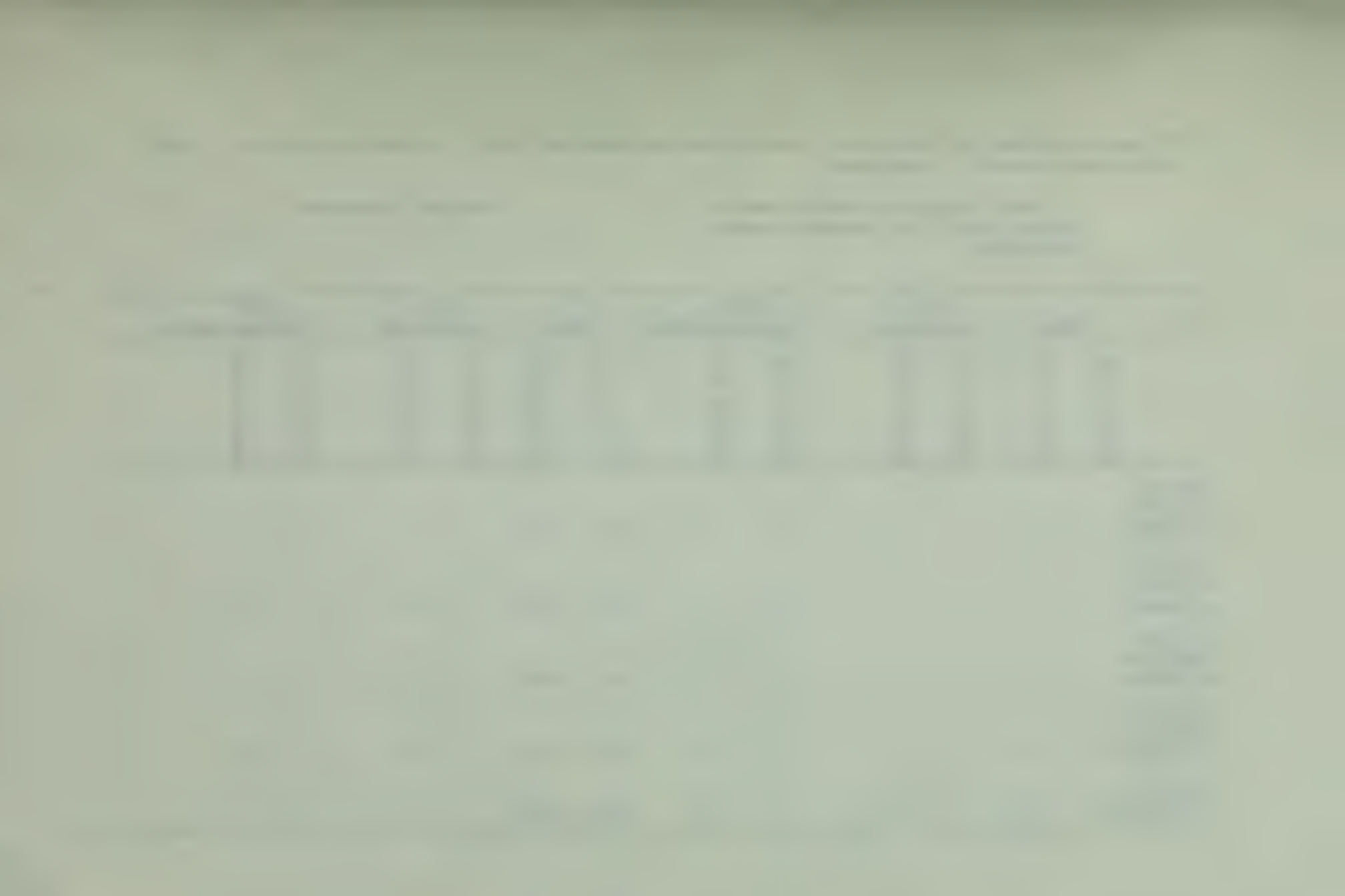
	Navy		CQC Contractor		CQC Representative		Navy		CQC Contractor		CQC Representative	
	Delete CQC	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC
Up to $100,000 per award	12	16	6	6	1	3	-	2	-	1	-	1
Up to $500,000 per award	16	12	6	7	1	2	-	8	3	3	-	2
Up to $1Million per award	18	7	5	3	-	2	3	10	3	5	-	2
Up to $3Million per award	18	7	2	1	-	3	10	12	5	8	-	1
Unlimited per award	12	3	-	1	-	1	5	10	4	3	-	-



5) To your knowledge, do contractor in the following categories have a tendency to provide: (check one in each column). (continued)

c) Level of Quality Control that is higher than (b) to enhance company reputation

	Navy		CQC Contractor		CQC Representative		Total No. Responses Navy		CQC Contractor		CQC Representative	
	Delete CQC	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC
Up to $100,000 per award	-	-	-	-	-	1	12	18	6	7	1	5
Up to $500,000 per award	-	-	-	1	-	1	16	20	9	11	1	5
Up to $1Million per award	1	1	-	1	1	3	22	18	8	9	1	7
Up to $3Million per award	2	4	3	7	1	6	30	23	10	16	1	10
Unlimited per award	1	9	2	2	1	4	18	22	6	6	1	5



7) How often does the contractor on his own initiative require his forces to redo work that is not satisfactory? (check one) ____Never; ____1-5%; ____6-10%; ____11-15%; ____16-20%; ____21% +.

		Never	1-5%	6-10%	11-15%	16-20%	21% & Greater	Total
Navy	Delete CQC	6	17	4	-	-	1	27
	Retain CQC	-	21	3	-	-	1	25
CQC Contractor	Delete CQC	-	3	4	1	-	3	11
	Retain CQC	-	9	4	-	1	2	16
CQC Representative	Delete CQC	-	1	-	1	-	-	2
	Retain CQC	-	6	3	-	-	-	9

8) In considering past CQC contracts, do you think that: (check one answer per question)

			Always	Often	Sometimes	Never	Total
a) Navy personnel have understood CQC							
	Navy	Delete CQC	4	13	9	1	27
		Retain CQC	2	7	15	-	24
	CQC Contractor	Delete CQC	2	2	6	1	11
		Retain CQC	8	3	8	-	19
	CQC Representative	Delete CQC	-	1	1	-	2
		Retain CQC	2	2	6	-	10
b) The CQC Representative can be on the contractor's payroll and properly inspect the work							
	Navy	Delete CQC	1	2	20	4	27
		Retain CQC	4	13	6	3	26
	CQC Contractor	Delete CQC	2	6	2	1	11
		Retain CQC	10	8	-	1	19
	CQC Representative	Delete CQC	-	1	-	1	2
		Retain CQC	6	2	2	-	10

		Always	Often	Sometimes	Never	Total
c) The Navy overinspects its CQC jobs						
Navy	Delete CQC	1	5	8	13	27
	Retain CQC	2	3	13	8	26
CQC Contractor	Delete CQC	3	2	3	2	10
	Retain CQC	-	2	13	4	19
CQC Representative	Delete CQC	1	1	-	-	2
	Retain CQC	1	1	5	3	10
d) The CQC plan is a valuable asset to the contractor's inspection program						
Navy	Delete CQC	5	4	17	1	27
	Retain CQC	10	8	5	2	25
CQC Contractor	Delete CQC	1	3	5	2	11
	Retain CQC	10	8	1	-	19
CQC Representative	Delete CQC	-	1	1	-	2
	Retain CQC	4	2	4	-	10
e) The three stage inspection operation (preparatory, initial, follow-up) gives the contractor a satisfactory inspection program						
Navy	Delete CQC	4	10	10	1	25
	Retain CQC	5	9	12	-	26
CQC Contractor	Delete CQC	1	3	6	1	11
	Retain CQC	10	7	2	-	19
CQC Representative	Delete CQC	-	2	-	-	2
	Retain CQC	5	5	-	-	10
f) The Navy should specify the number and qualifications of CQC personnel in the contract						
Navy	Delete CQC	16	3	5	2	26
	Retain CQC	7	6	6	3	22
CQC Contractor	Delete CQC	6	1	1	3	11
	Retain CQC	7	3	6	3	19
CQC Representative	Delete CQC	1	-	-	1	2
	Retain CQC	9	1	-	-	10

		Always	Often	Sometimes	Never	Total
g) The CQC requirements in the various divisions of the contract give the contractor enough information to plan a good CQC program						
Navy	Delete CQC	6	12	8	1	27
	Retain CQC	5	14	4	2	25
CQC Contractor	Delete CQC	3	6	2	-	11
	Retain CQC	4	10	5	-	19
CQC Representative	Delete CQC	1	1	-	-	2
	Retain CQC	4	3	3	-	10
h) A program like CQC could be used on non-government jobs						
Navy	Delete CQC	2	7	10	6	25
	Retain CQC	5	15	6	-	26
CQC Contractor	Delete CQC	2	3	4	2	11
	Retain CQC	4	11	3	1	19
CQC Representative	Delete CQC	1	1	-	-	2
	Retain CQC	2	5	3	-	10

9) Do you feel that the CQC contractors that you have worked with have (check one answer per question) (Navy Personnel & CQC Representatives only)

a) Had a good regard for inspection						
Navy	Delete CQC	1	3	23	1	28
	Retain CQC	2	12	11	-	25
CQC Representative	Delete CQC	2	-	-	-	2
	Retain CQC	3	5	1	-	9
b) Provided satisfactory Quality Control Inspection						
Navy	Delete CQC	-	1	26	1	28
	Retain CQC	-	15	10	-	25
CQC Representative	Delete CQC	1	1	-	-	2
	Retain CQC	3	5	1	-	9
c) Provided satisfactory Job Progress Inspection						
Navy	Delete CQC	-	4	22	3	29
	Retain CQC	-	14	11	-	25
CQC Representative	Delete CQC	1	1	-	-	2
	Retain CQC	3	5	1	-	9

		Always	Often	Sometimes	Never	Total
d) Provided satisfactory Final Acceptance Inspection of each stage of the work						
Navy	Delete CQC	-	3	19	5	27
	Retain CQC	-	10	13	2	25
CQC Representative	Delete CQC	-	2	-	-	2
	Retain CQC	2	4	2	-	8
e) Provided satisfactory mechanical inspection						
Navy	Delete CQC	-	2	20	4	26
	Retain CQC	-	9	16	1	26
CQC Representative	Delete CQC	1	-	1	-	2
	Retain CQC	2	3	4	-	9
f) Provided satisfactory electrical inspection						
Navy	Delete CQC	-	2	22	4	28
	Retain CQC	-	10	15	1	26
CQC Representative	Delete CQC	1	-	1	-	2
	Retain CQC	2	3	4	-	9
g) Provided satisfactory structural inspection						
Navy	Delete CQC	-	2	24	2	28
	Retain CQC	-	18	7	-	25
CQC Representative	Delete CQC	1	-	1	-	2
	Retain CQC	3	5	1	-	9
h) Provided satisfactory preliminary inspection						
Navy	Delete CQC	-	6	19	3	28
	Retain CQC	-	13	11	1	25
CQC Representative	Delete CQC	-	1	1	-	2
	Retain CQC	3	4	2	-	9
i) Provided satisfactory initial inspection						
Navy	Delete CQC	-	3	21	4	28
	Retain CQC	-	13	2	-	15
CQC Representative	Delete CQC	-	2	-	-	2
	Retain CQC	3	4	2	-	9

		Always	Often	Sometimes	Never	Total
j) Provided satisfactory follow-up inspection						
Navy	Delete CQC	-	2	22	2	26
	Retain CQC	-	14	10	-	24
CQC Representative	Delete CQC	1	1	-	-	2
	Retain CQC	3	3	3	-	9

10) At what contract dollar value should the job superintendent and the CQC representative be the same man? (check one answer) ____Never; ____less than $50,000; ____less than $100,000; ____less than $250,000; ____less than $500,000; ____less than $1 Million; ____less than $3 Million.

	Navy		CQC Contractor		CQC Representative	
	Delete CQC	Retain CQC	Delete CQC	Retain CQC	Delete CQC	Retain CQC
Never	9	4				2
less than $50,000	2	5		1	1	1
less than $100,000	2	1	1	2		1
less than $250,000	4	10	2	1		1
less than $500,000	5	6	3	6		3
less than $1 Million	1		3	6		1
less than $3 Million	4			2		1
Total	27	26	9	18	1	10

10) What % of the total contract award price does CQC usually run? _____% (CQC contractor only)

Category	number of responses used for mean	% of contract award price
a. Delete CQC	8	2.7
b. Retain CQC	16	1.8
c. CQC contractors (a&b)	24	2.1

11) Would you prefer to have the Navy perform the inspection and delete the CQC provisions from your contract? (check one)
____Yes; ____No.

	Yes	No
Navy	28	26
Contractor	11	19
CQC Representative	2	10
Total	41	55

APPENDIX N

Question 12: Navy Related Respondents

12) Any other comments that you would like to make about Contractor Quality Control in the Navy will be appreciated.

The following comments have been selected because they are the most representative of those received. They are presented according to the responses to question 11.

Navy Personnel who indicated that they wanted to return to NCIS and delete the CQC provisions from the NAVFAC General Conditions.

1. "We feel that the construction quality inspection on a CQC project is the sole responsibility of the contractor's CQC organization. It is the intent of the CQC program to alleviate the Government of the routine inspection task. We expect the CQC representative to devote full time to his interpretation of the plans and specifications and quality control inspection. Of course, the Government still needs to study the plans and specifications and make periodic site inspections, but the brunt of the inspection for faulty material, submittal checks, and quality workmanship should be conducted by the CQC organization. Any inspecting done by the Government should be of the double-check nature. Most of our contractors have had to import CQC organizations because of the absence of qualified local personnel. In contracts ranging from $50,000 to $100,000 it is impractical to employ more than one CQC representative because of the costs involved. Although jobs in this range are relatively small, one man has to be extremely sharp in order to stay ahead of the construction. Although CQC, by theory, was designed to release the Government of the inspection time, it has actually made little difference. Routine inspections by Government inspectors have, over the past, found many defects which should have been corrected by CQC. This creates an extremely high tension situation finding the inspectors cross checking the CQC representatives and causing

personal feelings to be injected into the Contractor-Government relationship. As you can well see, without a diplomatic Government inspector, things could get out of hand. It is our feeling that the Navy Construction Inspection System should be reinstated. As long as the Government builds strictly adhering to the contract specifications, it is more effective and less costly to use Navy Construction Inspectors."

2. "Contractor Quality Control will only work successfully with contractors who are construction people, and who are not primarily what we term brokers, who subcontract everything but the required 20% of the total amount of the work to be performed. The job superintendent and the CQC Representative must work in close harmony, which they do not presently do. It has been our experience in the past that the contractor will not spend the money to furnish the necessary professional people to back up the CQC Representative on the job. At this level, we feel that we received better inspection, quicker action, and better quality construction with the system prior to CQC."

3. "I don't see how the responsibility can be easily split between the contractor CQC and the Government. The Navy must, for its own interests, inspect all phases of construction. The contractor should because he is being paid to do so, if for no other reason. A separate CQC man was employed on the $250,000 contract that I am familiar with. He actually had little to do and spent most of his time estimating for other jobs. The Navy, nevertheless, was paying for his time. Even if a contractor

has good intentions it is still difficult for a CQC man to adequately monitor the job. Furthermore, the contractor often is not aware of exactly what the Navy's needs and requirements are. Thus the Navy, inspite of CQC, ends up spending just as much time inspecting (with reduced personnel). Thus, I feel that it would be best to delete CQC except for very large contracts."

4. "It would be interesting to compare CQC costs for large jobs with the cost for a fulltime Government Inspector. From past experience, CQC Reps make approximately $400/week which is about $20,000/year. I feel that, with the quality of CQC now obtained, this amount of money is not wisely spent. Why have a CQC Rep when a construction Rep must spend 50% of his own time making sure that the CQC Rep is doing his job? I will say that CQC can work and it has. But it is the result of: a good superintendent, a good CQC Rep, and a good relation between the two, and a General Contractor who has pride in his work and is willing to do what is necessary to provide a quality product. I would recommend the following (alternatives):
   1. Eliminate CQC and have a fulltime inspector, or
   2. Make the Superintendent the "CQC" Rep and have Navy surveillance/inspector.

   Actually, number two above is pretty much what we have now in a majority of cases. I would say that the Navy will have to accept more inspection of the contractor's CQC program to derive any benefit from the system."

5. "As long as the CQC Rep is on the Contractor's payroll the job will not be properly inspected by the CQC Rep and this requires the Navy Inspector to inspect more than just job surveillance."
6. "The level of competence demanded by a good CQC representative dictates a commensurate salary. This must be reflected in a responsible contractor's bid. On contracts of less than several million dollars this could be a determining factor in whether or not he is the low bidder."

Navy Personnel who want to retain the CQC provisions as part of the NAVFAC General Conditions.

1. "I definitely feel that CQC is the right way to go, but it all depends on the capability and caliber of the CQC representative and the willingness of the surveillance representative to do just that - not inspect. Unfortunately, although I have administered 6 CQC contracts, none had been a repeater - so we had to start all over again with each contractor. But my own people gained valuable knowledge from each one."
2. "Need to get away from the concept that CQC is a substitute for the Navy inspection. Should be clearly enumerated as a supplement to Navy inspection. Availability of qualified CQC R's in this area is a very serious problem. Need more publicity on the need for people with necessary experience and education, so that contractors will have more choice in selecting good CQCR's. (Aim at trade/vocational schools and schools offering Associate Degrees in Engineering). Government should reserve

right to approve selected critical shop drawings/submittals, and take advantage of design A/E's expertise in reviewing/approving these submittals."

3. "Basically, the CQC system is as good as the attention the general contractor gives to it. For some, it works well! For others, it's a license to steal."
4. "CQC is an excellent contractual tool which tends to make the contractor aware of his obligations to achieve the specified level of quality in the construction. Drawbacks include the initial learning curve and unfamiliarity with NAVFAC and Federal reference specifications."
5. "The CQC program varies drastically from contractor to contractor. The key to the program is convincing the president of the firm he needs CQC and then getting a stronger individual on the job site than the superintendent."
6. "If we can ever convince the Navy Construction representatives that the CQC system is a help to them rather than a threat, then the system will work much better."
7. "CQC is good from the standpoint of requiring the contractor to plan his work. However, the fault lies in the fact that contractor's just don't "Work their Plan" and get so far behind in administrative red tape, especially on contracts less than $500,000, that the plan just goes out the window. Another fault with CQC is that not enough Navy Personnel, Civilian and Military, are familiar with CQC enough to make it work properly. I have found through experience that on smaller contracts (less than $500,000), Contractors look at CQC as just another bit of

unnecessary red tape to contend with. However on large CQC contracts (greater than $1 million) Contractors have very good CQC programs and managers. In some respects, I personally think that CQC requirements are too cumbersome on smaller CQC contracts and should be streamlined or dropped altogether. However, on large CQC contracts, CQC works well and is a definite payoff for both the Government and Contractor."

Contractor Quality Control Representatives who want to delete the CQC provisions from the NAVFAC General Conditions and have the Navy perform the inspection.

1. "CQC could work if the Navy would let it. We have our hands tied when it comes to changed conditions. Change orders take three times as long and are more difficult to arrive at. We must inspect only to be inspected. The job superintendent should be the CQC - why should a contractor be made to review and approve submittals, if he can make no changes?

Contractor Quality Control Representatives who want to retain the CQC provisions as part of the NAVFAC General Conditions.

1. "The CQC program aids in promoting cooperation between sub-contractors, engineers, owners, architects, etc. It depends heavily on the integrity of the contracting firm. It's the best program for the best companies."

2. "The 'job superintendent' should be his own best critic, but with a competent CQC representative and cooperation with each other, they should be able to interpret and prevent many problems before they occur; providing they also work with 'reliable' contractors."
3. "The Navy has never before, in my experience, had the in-depth control of quality and inspection that it has now. A construction representative has always been assigned "X" number of millions of dollars to inspect and could not possibly thoroughly cover all of the construction involved, nor could he be as aware of the submittal requirements, plans or specifications. The CQC program is a good one but needs refining to standardize specifications, reporting procedure, and inspection level."
4. "All contractors, to my knowledge use the lowest subcontractor bid on jobs of any size. In this respect on complex jobs such as plating shops or hospitals the number of Registered P.E. man hours of onsite inspection should be clearly stated in the contract specifications. The COE has specified certain CQC onsite Representative requirements on large complex jobs."

Contractors who want to <u>delete</u> the CQC provisions from the Navy contract and have the Navy perform the inspection.

1. "The Navy should either depend upon and utilize the CQC system fully or abandon it."
2. "CQC ties up services and the abilities of an additional supervisory type individual - hence cutting down on amount of work a firm can do (only a limited number of qualified personnel

are available) - hence cutting down profit potential."

3. "If some level could be established to limit the competitive portion and if the level of the CQCR could be established high enough, so they could authorize field changes, it would be a help."

4. "It is my opinion that the introduction of a Quality Control Supervisor by the General Contractor into a construction operation where he operates autonomously with the General Superintendent or Project Manager produces an unacceptable level of friction in one instance or an equally unacceptable atmosphere of collusion in another, neither of which can bode well for the successful accomplishment of the work at hand. Traditionally, the Project Superintendent has always had two primary responsibilities, one for coordination and productivity and the other for quality control. To suddenly present this man with an individual placed upon the job as a quality critic is almost certain to diminish the effectiveness and morale of the superintendent. The voluminous paper work traditionally involved in CQC programs is very often a tedious exercise in bureaucracy. I am keenly aware that many general contractors are providing the government with something less than good quality but I am convinced that the CQCP as presently conceived is not the proper answer to this problem."

Contractors who want to retain the CQC provisions as part of the NAVFAC General Conditions.

1. "We think it puts greater professional conduct in the hands of Contractor Field Personnel. The "Honor System" aspects, also, make for responsible superintendents."
2. "We like the CQC program - it has helped our jobs come in at our estimates. It helps us meet schedules, keeps subs in line, and have less delays."
3. "As is so often the case, it's the people involved that make projects succeed or fail and that is why it is so difficult to say a program is 100% good or 100% bad."
4. "CQC makes contractors out of brokers."
5. "I feel it is one of the better tools for a contractor to use to control his work."
6. "We have been pleasantly surprised with the results of CQC. We entered the contracts with a strong suspicion that it would never work and have been happy with our experience.
7. "In my most recent experience on a Navy CQC contract, I found the ROICC office often used the CQC program as a means for them to shirk their own responsibilities while making sure that the contractor met all of his. Unless the responsibilities of both the Government and the contractor are clearly specified, and I cannot over-emphasize the word 'clearly' the quality control system of contract administration will never reach its intended goal."

APPENDIX O

Similar Questions That Were Asked of All the Respondents

Respondent Categories	Similar Questions*																	
Architect/Engineer	1	2	3a	3b	3c	4i	4ii	4iii	4v	4iv	7	5	6	10d	10e	10g	10f	8
Contractor	1	2	3a	3b	3c	4a	4b	4c	4d	4e	5	7	6	10c	10d	10f	10e	8
Navy/CQC Representative	1	2	3a	3b	3c	4f	4a	4b	4c	4d	5	6	7	41	4m	4e	4n	8h
CQC Contractor	1	2	3a	3b	3c	4f	4a	4b	4c	4d	5	7	6	41	4m	4e	4n	8h

Table of Similar Questions that were asked of all the respondents.

*Note: The numbers in this table correspond with those on the applicable questionnaires in Appendices A, B, and C.